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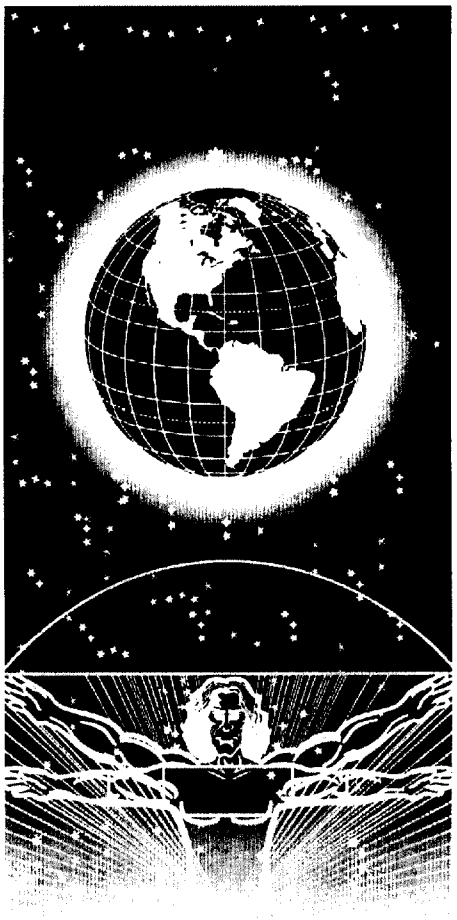

UNITED STATES AIR FORCE
AFIOH

Sampling and Analysis Plan for the Collection of Ambient Air Samples at Receptor Locations from Open Pit Burning Operations in the Deployed Environment

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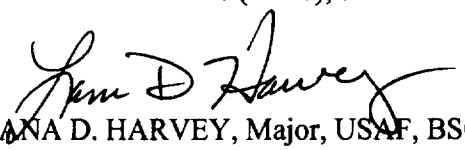

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13. ABSTRACT *(Maximum 200 words)*
Open pit burning is a common practice to dispose of solid waste at deployed locations. Pits are ideally located down wind of inhabited areas; however, changes in wind direction may cause personnel exposure to the smoke. This guide provides a general sampling strategy to address these exposures based on possible contaminants of concern. Included are specific ambient air sampling protocols, analysis methodologies, laboratory contacts and sample shipment requirements.

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open pit burning, solid waste burning, deployment, ambient air monitoring, air pollution, air sampling, air monitoring

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TABLE OF CONTENTS

LIST OF TABLES

SAMPLING AND ANALYSIS PLAN FOR THE COLLECTION OF AMBIENT AIR SAMPLES AT RECEPTOR LOCATIONS FROM OPEN PIT BURING OPERATIONS IN THE DEPLOYED ENVIRONMENT

1. Introduction

In response to a CENTAF (F)/SG Priority A task concerning the health effects of solid waste burning at OIF sites, the Air Force Institute of Operational Health, Risk Analysis Directorate, Environmental Analysis Division (AFIOH/RSE) developed a sampling and analysis plan for the collection of ambient air samples to quantify air contaminants produced by open pit burning operations. The plan is devised so that samples can be taken at receptor locations in the deployed environment. AFIOH/RSE personnel researched and identified the sampling technologies needed to capture the exposures, developed a list of possible contaminants, and assessed the costs involved with the ambient air sampling process. This sampling plan is intended to provide the specific ambient air sampling protocols and analysis methodologies required for deployed base-level personnel to initiate sample collection, shipment and analyses necessary to quantify the levels of contaminants generated by open pit burning. The ambient air sampling methodologies and analytical methods applied in this plan are based on methodologies developed by the U.S. Environmental Protection Agency (EPA). Specific, step-by-step instructions for air sample collection procedures are outlined in detail in U.S. Army Center for Health Promotion and Preventive Medicine (USACCHPPM) Technical Guide (TG) 251.

The air pollutants of concern are generated during the open pit burning of solid waste. Specific types/amounts of each pollutant depend on the composition of the waste materials being burned. Heat and airflow also contribute to the amount of contaminants released in air because incomplete combustion that results in low heat and smoldering tends to produce more smoke. Generally, pollutants may include varying amounts of dioxins, furans, particulate matter, polycyclic aromatic hydrocarbons, volatile organic compounds, carbon monoxide, and hexachlorobenzene. Ambient air samples will be collected during the open pit burn operations at receptor sites affected. Affected sites will depend on local meteorological conditions and their impact on the plume direction and concentration.

2. Objective

The objective of this sampling and analysis plan is to provide to the deployed BEE the type of samples to collect, the method of sampling to use, and the proper analysis to request when quantifying the exposure levels of deployed personnel to contaminants generated during open pit burning. This plan is generic in nature so that it can be applied to most receptor locations.

3. Sample Types

To quantify the exposures of open pit burning the following samples should be collected using the referenced method.

TABLE 1. Sampling Types

Contaminants	Number of Samples	Method	Media/Sampling Device
PM_{10} Particulates	12	40 CFR, Parts 1-51, Part 50, Appendix J, July 1, 1993	MiniVol Sampler High-Volume Particulate Sampling
Volatile Organic Compounds	8	EPA Method TO-14	SUMMA Canisters
Dioxins/Furans & PAHs	12	EPA Method TO-9A	PUF Sampler
Semi-Volatile Organic Compounds	8	EPA Method TO-13A	PUF or XAD (fiberglass) high volume method.
**Meteorological Conditions	1 reading per hour on sampling days		Weather services or direct reading instruments if available

**Accurately recording existing meteorological conditions is imperative to the sampling process. The analytical results of the air sampling are just the beginning. Adequate health risk evaluations for populations located down wind of the burn pit mandate the constant collection of wind direction, wind speed, temperature, barometric conditions, and observations of changing weather conditions, e.g. low-hanging overcast skies, clear skies, etc. Meteorological conditions have a direct impact on predicting the amount of contaminants that could reach downwind populations. These data must be accurately recorded on at least an hourly basis throughout the 24-hour sampling period. If direct reading instruments are not readily available then the sampling team may rely upon local weather services, but personal, first hand observations of the plume and surrounding environmental conditions should also be noted on the sample collection forms.

4. Sampling Frequency

The amount of samples taken will depend on the sampling equipment that is available at the deployed location. At a minimum, one set of samples should be placed at the receptor location and one set should be located in an upwind position in relation to the burn pit to capture background concentrations. Ideally, multiple samples should be collected at all established wind directions to better define pollutants contributed by other sources located upwind and downwind under all meteorological conditions. Sampler inlets should be pointed to face into oncoming wind at a height of about breathing zone level (approximately 2 meters above ground). The end result of downwind sampling will constitute a "worst-case" picture of pollutant concentrations for future health risk evaluations. Upwind and crosswind sample results should establish levels of pollutants contributed by other sources of pollution and the background levels present in ambient air. With the exception of VOCs, ambient air samples will be collected at the afore

mentioned locations over periods of 24 hours beginning immediately after burn initiation and continually throughout the 24-hour burn period or until combustion is complete, to include smoldering periods. To measure dioxins and furans in their expected concentration range the sampling period will have to be extended from the EPA Method TO-9A time of 24 hours to 72 hours. This will allow enough volume of air to pass through the sampler so that a measurable amount of contaminant is collected. Sampling frequency is illustrated in chart provided below:

Table 2. Sampling Frequency

	Wind Direction:				
Sample Location:	**NE (background)**	**SE (background)**	**SW (background)**	**NW (background)**	**RECEPTOR Location**
Dioxins/Furans	2– ***72 hour samples***	2– ***72 hour samples***	2– ***72 hour samples***	2– ***72 hour samples***	4– ***72 hour samples***
VOCs	1 - ***8 hour samples***	1- ***8 hour samples***	1- ***8 hour samples***	1- ***8 hour samples***	4- ***8 hour samples***
Particulates (PM10) ***24 hour samples***	2– ***24 hour samples***	2– ***24 hour samples***	2– ***24 hour samples***	2– ***24 hour samples***	4– ***24 hour samples***
Meteorological Data Collection	Hourly x 72 hours	Hourly x 72 hours	Hourly x 72 hours	Hourly x 72 hours	Hourly x 72 hours

5. Sampling Procedures

Particulate Sampling - Airmetrics MiniVol Particulate Sampler Instructions

The MiniVol samples the air at 5 liters per minute for particulate matter (TSP, PM10, and PM2.5). The sampler is designed to be portable to sample the air at a discrete location or to be used in saturation sampling. Electrical power or a permanent structure is not required. While the MiniVol is not EPA approved as a reference method, it has been proven to equivalent to the standard reference methods. The sample battery pack is designed for 24-hour continuous sampling. For detailed sample collection procedures of PM10 samples using the MiniVol PM Sampler, refer to the AFIOH Field Manual (v4.2), March 2000, provided in Attachment 1.

VOC Sampling - Ambient Air Volatile Organic Compound (VOC) Summa Canister Sampling (TO-14A)

VOCs are collected according to EPA Method TO-14A using SUMMA polished, evacuated stainless steel canisters. Sub-atmospheric, passive, sampling does not require a power source. This type of sampling provides a high level of portability for remote field sampling. Sampling periods from 8 hours, 24 hours, and up to one week may be selected for the sampling mission requirements. Eight-hour samples are all that is required for this particular sampling plan. Flow rates are determined by the capacity of the canister, the desired sampling period, and the ambient conditions (temperature and barometric pressure). Flow rates are controlled using a flow

restrictor manufactured by Entech and canister vacuum measurements are taken with the vacuum gauge attached to the restrictor. The canisters and flow restrictors will be prepared in advance and the vacuum gauge on the flow restrictors will be calibrated according to TO-14A prior to field deployment. Field personnel will only need to set/calibrate the flow rate of the restrictor at the sampling location. For detailed sample collection and equipment operation procedures refer to Attachment 2, Excerpt Taken from USACHPPM DRAFT TG-251.

Dioxins/Furans and PAH Sampling – PS1 Sampling Instructions

The PS-1 sampler is used to conduct the following EPA reference methods:

- TO-4A Polichlorinated/polybrominated
- TO-9A chlorinated/brominated debenzo-p-dioxins and dibenzofurans
- TO-13A polycyclic aromatic hydrocarbons (PAHs)

These sampling methods are used for source specific sampling (i.e. incinerators, open burning, manufacturing facilities, aerial spraying of crops, etc). This method will be used during this sampling effort as the plan is designed for open pit burning surveillance to establish baseline levels. For detailed sample collection and equipment operation procedures, refer to Attachment 3, PS1 Sampling Instructions.

6. Sampling Equipment & Analyses

If sampling equipment is not available it must be requested through the analytical laboratory along with the sampling media. The oil well sampling kits maintained by AFIOH/RSE will include the mini-vol and TSP, (see Attachment 4 for kit inventory) but SUMMA canisters must be ordered directly from the laboratory. The analytical laboratory of choice will provide special packaging requirements; storage conditions and shipping procedures will be provided along with sampling media and devices upon request. Contact one of the following laboratories to obtain supplies, equipment and collection devices:

- U.S. Air Force: http://www.brooks.af.mil/afioh/Laboratories/sdc_sdce.htm

  AFIOH/SDCE - Technical Analysis Branch
  2350 Gillingham Drive
  Brooks City-Base TX 78235-5103
  DSN 240-6176/6177
  COMM (210) 536-6176/6177
  FAX DSN 240-4578

- U.S. Army: http://chppm-www.apgea.army.mil/dls/default.asp

	**For Routine Correspondence/Samples:** Commander, USACHPPM ATTN: MCHB-TS-LID (Sample Management Laboratory) 5158 Blackhawk Road Aberdeen Proving Ground, MD 21010-5403
 **FedEx®** ®	**For Sample Shipments:** Commander, USACHPPM ATTN: MCHB-TS-LID (Sample Management Laboratory) Building E2100 Aberdeen Proving Ground, MD 21010-5403

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Appendix A
MiniVol Field Manual

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Air Force
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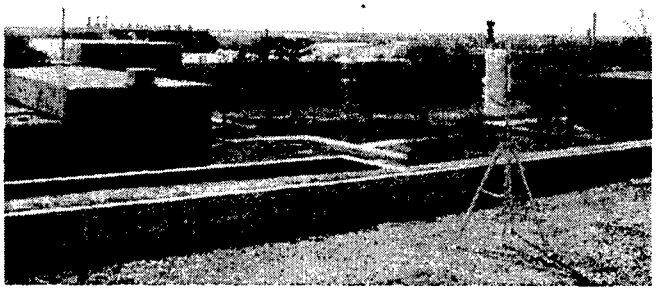
Risk
Analysis

FIELD MANUAL

Ambient Monitoring for Particulate Matter

using the

MiniVol™ Portable PM Sampler (V4.2)



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2513 Kennedy Circle Brooks AFB, TX 78235-5123
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March 2000

TABLE OF CONTENTS

1.0 BACKGROUND

This manual was developed as a practical field guide for environmental surveillance personnel who will perform monitoring of ambient airborne particulate matter (PM) with the Minivol™ portable air sampler. The manual provides a basic overview of the instrument and the ambient PM sampling method, along with a sampling protocol that guides the operator through sequential, step-by-step monitoring tasks. This manual consolidates relevant information from EPA sampling methods, the manufacturer's technical manual, field studies, lessons learned from previous users, and guidance from AFIERA personnel with a background in air contaminant monitoring. The PM ambient monitoring process presents numerous opportunities to introduce error. This guide was designed to highlight those pitfalls, guide personnel around them, and to promote continuity from sample event to sample event. Additional technical advice may be needed from AFIERA on occasion; information such as schematics or part numbers can be obtained from the manufacturer's technical manual provided with the instrument.

The Airmetrics Minivol™, as equipped, can be configured to sample particulate matter having an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$), as well as PM_{10} and total suspended particulates (TSP). Toxic metals can be sampled as well.

This instrument was developed jointly by the US Environmental Protection Agency (EPA) and Lane Regional Air Pollution Authority. It was specifically designed for use in remote locations. The Minivol™ is compact, lightweight, weather resistant, and can be operated by AC or battery power. Although not a federal reference method (FRM) sampler, the instrument provides results that closely proximate reference method data, when used as directed. The instrument has been used successfully by the US EPA, Army, State Agencies, and private industry.

AFIERA would like to thank Jim Howes (CH2M Hill, International) and the Deployment Environmental Surveillance Program, US Army Center for Health Promotion and Preventive Medicine (CHPPM) for their inputs in the development of this instruction manual.

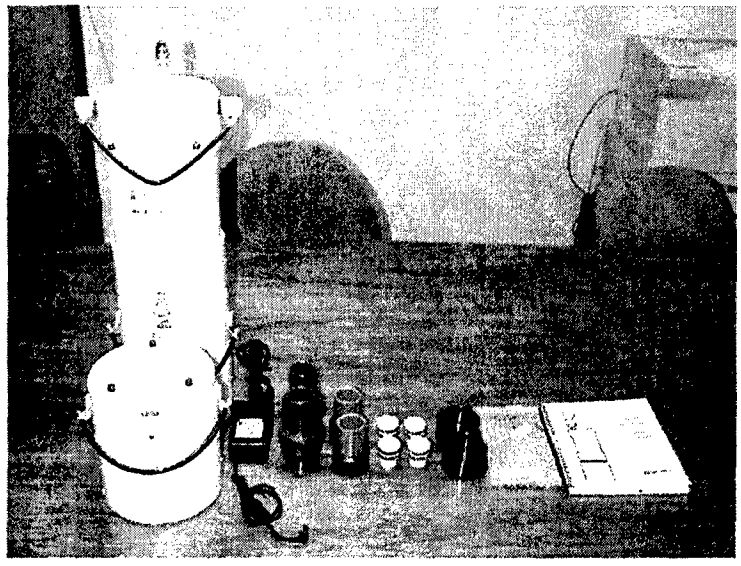
2.0 EQUIPMENT, ACCESSORIES AND SUPPLIES

2.1 Each sampler comes equipped with the following items, as viewed left to ***right in the photograph below:***

- Air Sampler Module w/(2)

Rechargeable Batteries

- AC Power Cable
- Filter Holder Assemblies (2)
- Preseparator Adaptors (2)
- Impactor Assemblies (2 each: $PM_{2.5}$ and PM_{10})
- Raincaps (2)
- Spare Parts Kit
- Manf's Technical Manual



Basic Sampler Package

2.2 In addition, the following items were added with the shipment:

- Bottle, Solvent
- Calibrator, BIOS DC-Lite 12K
- Calibration Adaptor
- Cleaning Brush
- Dropper Bottle (for solvent/grease application)
- Filter Cassettes (2, extra)
- Filter Cassette Shoe (to open cassettes)
- Forceps, Non-Serrated
- Gloves, Nitrile, Non-powder
- Grease, Glisseal (60g)
- Rubber Bands (to secure petri dish covers)
- Telescoping Hoisting Pole Assembly
- Tripod Pole Support
- Utility Wipes, Lint-free
- Zip Lock Bags (filter assembly transport/shipping of filters & paperwork)

2.3 The following supplies should be acquired locally:

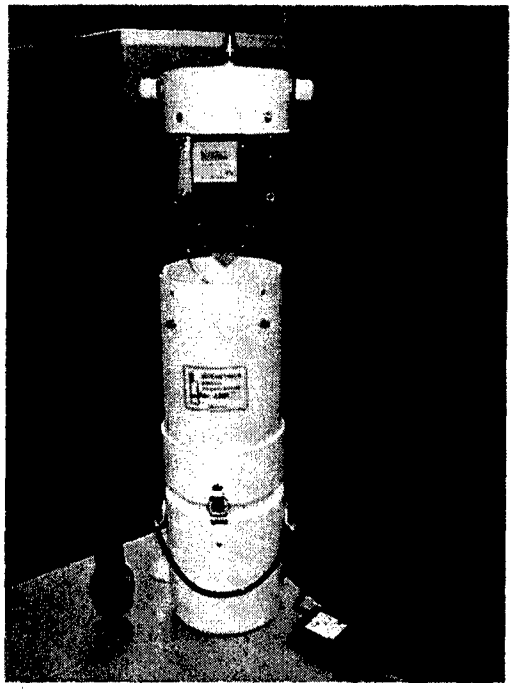
- AA Alkaline Batteries (replace timer battery at 6 months or once/rotation)
- Hexane, Unleaded MoGas, Lighter Fluid, or Lantern Gas (grease solvent/cleaning agent)

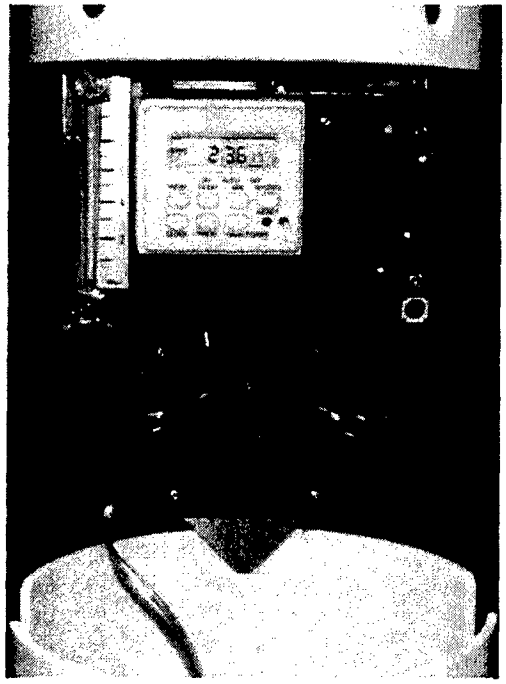
3.0 MINIVOL™ OVERVIEW

The Minivol™ portable air sampler is designed to sample at a constant rate of **5 liters per minute** for particulate matter ($PM_{2.5}$, PM_{10}, and TSP). The filters can subsequently be analyzed for toxic metals. The Minivol™ can also be used to collect ambient air samples for non-reactive gas (CO/NO_x) analysis. However, the instrument will not be used for this purpose and is therefore not equipped for this procedure. Disregard those sections in the manufacturer's technical manual regarding gas sampling.

Ambient monitoring is based on EPA sampling protocol, which incorporates stringent *Quality Control*. Because the method requires precision mass measurement of PM in the micrometer range, there is very little margin for deviation from the detailed procedures outlined in this manual. Although there are similarities to industrial hygiene air monitoring, the equipment and overall process is significantly more involved and tedious. Personnel must take the time to familiarize themselves with the equipment and the proper monitoring procedures before initiating PM sampling. Pay special attention to the precautions that have been highlighted in **blue**. The Minivol is essentially a constant flow pump with a number of control and diagnostic features. The primary operational features of the instrument are described below.

Access the control panel by pressing the two release pins on the front of the instrument casing simultaneously. Grasp the top cap and lift the pump/control panel assembly out of the PVC casing. One way to accomplish this procedure is by performing the operation while standing behind the instrument. **The pump/panel assembly will not lift completely out!** It is attached to the unit by the power line, which is in the form of a phone plug-in jack. **Do not grasp the circuit board.** Rest the control panel on the PVC case by slipping the triangular mount stand over the lip of the casing. **This is not a firm support, so be careful!** Standing the instrument against a structure can provide additional support, and is highly recommended.

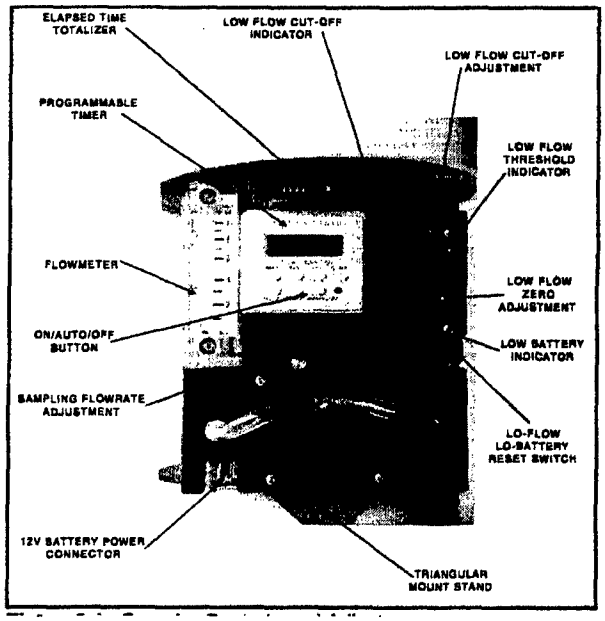




3.1 FEATURES

Battery-Operation: The rechargeable, 12-volt lead-acid batteries provide 24 hours of sampler operation (when fully charged). The U.S. Army has had good success operating the samplers by battery in SW Asia. Some special notes:

- A green LED on top of the battery illuminates while the battery is charging. The light will turn off to indicate a full charge.
- A fully discharged battery may require 14-18 hours of recharging. If it is to be used frequently, leave it plugged into the charging transformer where it will continue to receive a trickle charge. To prevent damage:
  - **do not store the battery for extended periods while being charged**
  - **do not store the battery while connected to the sampler**
- The instrument will also operate from an AC power source by simply connecting the transformer/recharge cord from the power source to the battery. In this configuration, the AC overrides the battery (while it provides a trickle charge to the battery).
- Should the batteries fail to supply sufficient voltage (below 10.3 volts), the instrument will shut down. A **LOW BATTERY** indicator will illuminate on the control panel if the instrument ceases operation for this reason.
- Connect the battery to the bottom of the sampler by inserting the three pins on the sampler into the receptacles on top of the battery (the battery can only fit one way).



Lock the side latches.

Programmable Timer: A timer on the control panel can actuate the pump manually, or in the timer mode. The timer can be set up to initiate six separate runs within any period of up to seven days (*normally, the unit will be programmed to make one run over a single period of 24 hours*). The timer is powered separately by the AA alkaline battery located above it. It is under a constant drain. **Replace this battery at 6-month intervals—observe the correct polarity when installing!** Refer to Page 11 of this manual for instructions on turning the sampler on and off, setting the real-time clock, and setting the timer. **Practice setting and clearing the timer before attempting to sample for the first time.** This feature is probably the most difficult to fully grasp.

Elapsed Time Totalizer (ETT): Located at the top of the control panel, this feature displays the total number of hours the unit has operated. The totalizer accumulates time only when the pump is running. It cannot be reset to zero. Although the manual indicates the totalizer reads in hundredths of hours, it actually reads in tenths of hours. So there is a six-minute interval between each incremental change. **This feature should not be used for timing purposes.** However, **ETT readings are to be recorded before and after each run for QC and troubleshooting purposes.**

Constant Flow: The instrument is designed to maintain a constant flow rate despite increased resistance, such as from filter loadings. The pump will automatically shut off if the flow rate drops below an established threshold of between 10% and 20% below 5 lpm (4.5 and 4.0 lpm, respectively). **LOW FLOW ADJUST** and **LOW FLOW ZERO** adjustment screws are located on the front panel. **AFIERA has already adjusted this threshold to 10%. No further adjustment should be necessary.** An indicator labeled **THRESHOLD** on the front panel will illuminate any time the flow drops below the set threshold. However, this indicator is used only when making the threshold adjustments as described on Page 15 of the technical manual. **Don't confuse this with the LOW FLOW indicator**, which will illuminate if the pump remains below the threshold for more than a few seconds, initiating premature pump shut down and an invalid sampling run. When a low flow condition shuts down the sampler, press the **RESET** button on the control panel to restart the sampler.

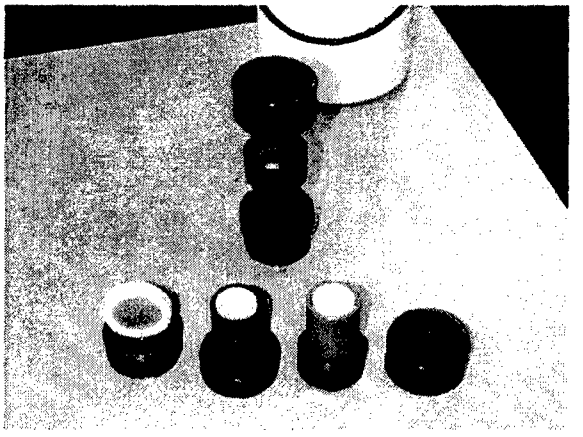
Flow Adjust: The **FLOW ADJUST** knob is used to regulate the flow to 5.0 lpm (actual/ambient conditions) during calibration. **Do not deviate from a setting of 5.0 lpm.** The $PM_{2.5}$ and PM_{10} impactor design requires this actual flow rate for proper particle size separations.

Flow Meter: The flow meter (rotameter) on the control panel **is not to be used for calibration or for recording the flow rate at the end of a run**, as indicated in the Airmetrics® technical manual. However, it can be used to aide in identifying flow problems (i.e., troubleshooting). Instrument calibration is discussed in **Section 4.2**.

Filter Holder/Pre-Separator Assembly: The apparatus shown below can be configured three ways to sample for either TSP, PM10, or PM2.5. It is assembled from left to right in a cascade fashion:

(1) Filter Holder w/Cassette

(2) Preseparator Adapter w/$PM_{2.5}$ Impactor
(3) Preseparator Adapter w/PM_{10} Impactor
(4) Rain Hat



A complete assembly is shown in the background. Note that the inlet for the PM_{10} impactor on the right is larger than the $PM_{2.5}$ impactor on the left. These impactors easily slide in and out of the adapters by pressing them from their bottom with your thumbs. **The impactors must be situated flush with the tops of the adapters.**

4.0 PM SAMPLING PROCEDURES:

Note: **New sampling locations require proper siting. Refer to Section 4.4, "SITING" prior to initial sampling.**

4.1 PRECALIBRATION

Note: **New Nitrile protective gloves should be worn when handling filters, filter holders and impactors. Very small artifacts and even body oils can adversely affect results.**

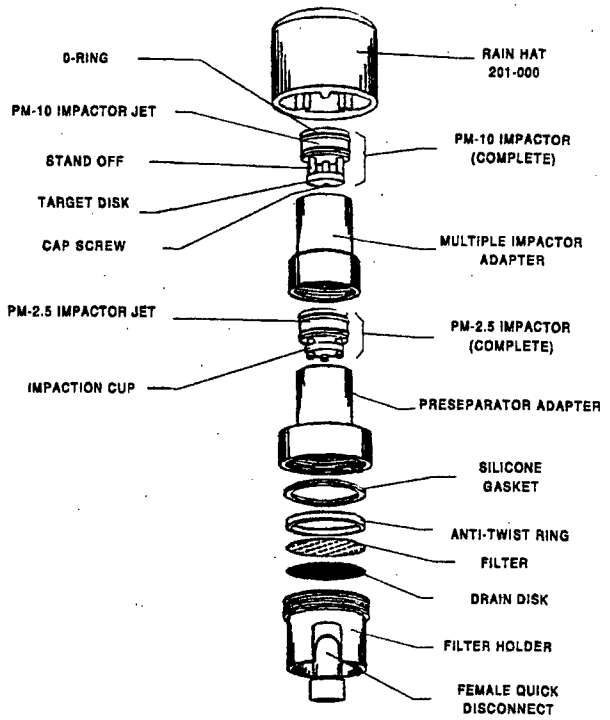
4.1.1 **Filter/Pre-separator Configuration:** Select the appropriate configuration:

$PM_{2.5}$ – The $PM_{2.5}$ configuration is shown below. It first requires the filter holder, then the screw-on adapter with $PM_{2.5}$ impactor insert, and finally a slide-on adapter with PM_{10} impactor insert. *Ensure the impactors are inserted with their tops flush with the tops of the adapters.*

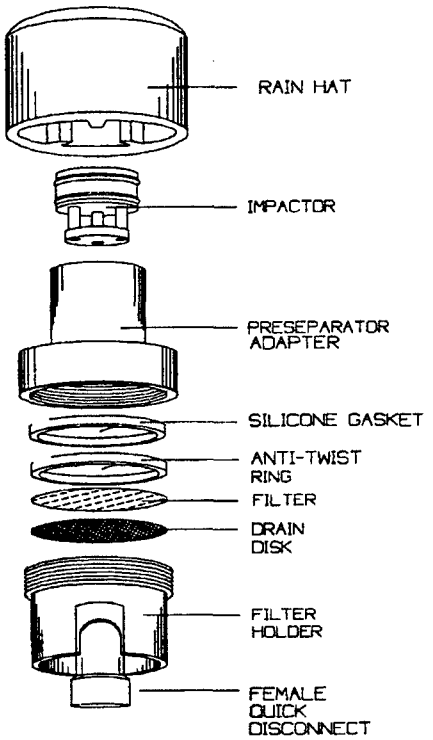
PM_{10} – The PM_{10} configuration requires the filter holder attached to the screw-on adapter. The PM_{10} impactor is inserted into the adapter.

TSP – The TSP configuration will not normally be used. However, specially directed surveys may require this setup when sampling for specific PM species. It requires only the filter holder attached to the screw-on adaptor. *No impactors are used.*

$PM_{2.5}$ Configuration



PM_{10} Configuration

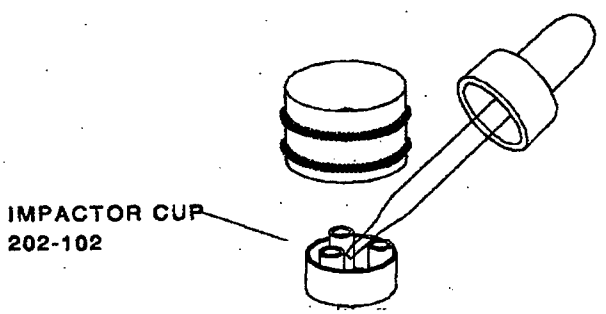


4.1.2 Filter Assembly and Impactor Preparation

Initially, and after every **two** sampling events (recommended for desert conditions), the impactor targets must be cleaned and re-greased. The cleaning/greasing frequency should be increased or decreased as needed, depending on ambient loadings and degree of soiling observed on the target disks. Note that the disks easily pull away from the impactor stand-offs.

1. Inspect the O-rings on the impactor for serviceability. If necessary, use another impactor or replace the O-rings.

2. The impactors can be cleaned by rinsing from top to bottom with a locally obtained solvent; a polyethylene squeeze bottle is recommended. Use a clean soft bristle brush if necessary. Hexane is preferred; however, unleaded mogas, lighter fluid, white gas or lantern gas are acceptable solvents. Let air-dry.



3. Grease the impactor target cup/plate as shown above. Prepare a mixture of the solvent and impactor grease in the dropper bottle by mixing a one-inch length of grease to **30** ml of solvent. Vigorously shake the mixture before each use until an opaque, uniform suspension, free from grease globs, is obtained.

4. Put two or three drops of the solution on the target plate. The drops should saturate the plate, flowing freely to the edge.

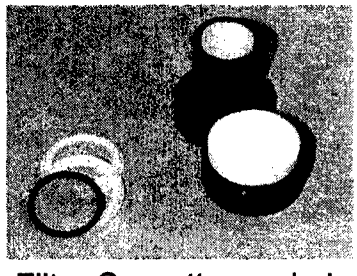
5. Let the target plate dry by allowing the solvent to volatilize, leaving a thin film of grease on the plate.

6. **Sparingly**, use a very thin film of grease (if needed) to lubricate the O-rings prior to inserting the reassembled impactor into a clean adapter. **Ensure the exterior of the impactor is clean and free of any artifacts** that could deposit onto the filter.

7. The adapter should be clean inside and out, free of any dust, residues or other artifacts. The adapters can be cleaned with warm soapy water and allowed to air dry. **Do not wipe down with materials that can leave lint.**

4.1.3 Filter Handling and Processing

Filter handling presents the greatest opportunity to introduce error. The lower volumes (and therefore less matter) encountered with the Minivol™ versus FRM samplers amplifies the significance of accurate filter weights. Accumulation of matter on the filter from other than the actual sample collection itself must be prevented. On the other hand, care must be taken to ensure PM collected during sampling is not lost afterward, or that material from the filter itself is not lost during handling. The 47mm quartz or teflon-coated glass fiber filters provided are delicate and easily damaged. Standard precautions:

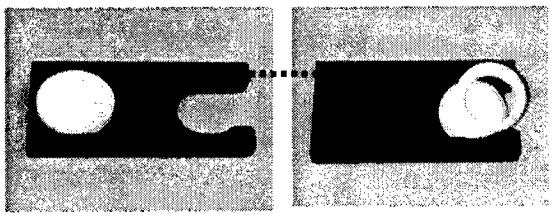


- Wear new Nitrile, no-powder gloves each time
- Load filters just before sampling, not hours/days prior
- Handle filters in clean area, away from air disturbances
- Use only non-serrated forceps, preferably teflon coated
- Handle filters by the *filter edges* only; never bend or fold
- Keep filters covered and protected when not actually handling
- Do not use any filter damaged, dropped, or otherwise contaminated

Filter Cassette: exploded view
and as loaded in Filter Holder

1. Open a **clean** Filter Cassette (FC).
2. Select a filter and carefully remove from petri dish by using the *precut forceps groove* in the side of the dish. **Do not attempt to "dig" the filter out of the dish.**
3. Inspect filter. **It must not be bent, torn, contain perforations, or be otherwise damaged.**
4. Place filter on the FC drain disk, **rough side up!** Reassemble the FC and place into the filter holder (as shown below). Screw the adapter on snugly.
5. Record the filter, filter holder, and sample numbers on the Field Datasheet.
6. Opening FC: Upon retrieval of sample or field blank, always use the Cassette Shoe to open FC to prevent loss of particulate matter. **Never pull apart the cassette to retrieve filter.**

Grasp cassette shoe with one hand; use thumb and forefinger of other hand to **maintain grip of cassette edges while sliding, to prevent cassette from flying apart** and disrupting PM deposits. Practice technique before actual sampling.



Field Blanks (FBs): Process one FB for every nine sampling events (unless instructed otherwise). FBs are loaded into a *clean* filter holder with appropriate impactors and carried to the site in a clean ziplock bag. Momentarily attach to sampler, remove, and immediately bring back to clean process area. **Handle and process as a normal sampling event—except FB's are not exposed to calibrations or the 24-hour sampling run.** Complete a datasheet for each FB.

Trip Blanks (TBs): Include one completely unused/unopened filter as a trip blank when shipping sampling filters and field blanks. Ensure it is appropriately labeled "Trip Blank".

Shipping Filters: All samples and blanks should be **stored/shipped upright** in their original, appropriately marked petri dishes. Secure dish covers with a rubber band and place in individual 3" x 5" zip lock bags. When shipping, include enough packing material to prevent movement during shipment. Include Field Datasheets and Meteorology Datasheets. Mark box "FRAGILE" and "UP⇧". Priority mail to appropriate lab as instructed.

4.2 CALIBRATION

Calibrate the instrument to sample at 5 liters per minute in the field (actual conditions) prior to all sampling runs. Because air density does not affect the flow rate readings of the BIOS™ flow meter (vs. rotameter), no corrections are required to ensure 5 lpm, actual conditions. Varying air densities also are not a significant factor in toxicological exposures to PM, so unlike gaseous pollutants, the EPA requires no STP corrections for particulate matter sample results (however, meteorological conditions will still need to be recorded for each sampling event).

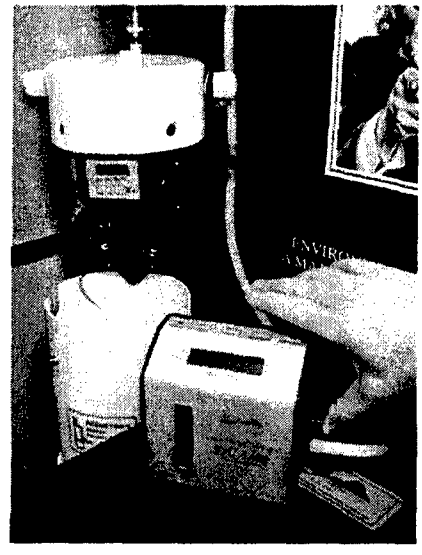
Airmetrics typically supplies a calibration curve for the instrument's rotameter. The company also sells a digital manometer that reads in static pressure, and a blue calibration orifice with a calibration curve and associated equations for conversions and corrections. These will not be necessary for calibrations or for calculating final flow rates. These procedures have been greatly simplified by the application of a BIOS™ DryCal® flow meter—a field-portable primary flow standard that provides direct calibrations in lpm. The Airmetrics' blue calibration orifice has been modified to interface with, and act as the instrument adapter for, the BIOS™ flow meter.

Operational Check: **Prior to each sampling run, the instrument should be checked out for leaks and given an initial calibration in a clean area. This will confirm the sampler is performing properly and will reduce any "tweaking" needed when calibrating in the field. Follow the procedures below.**

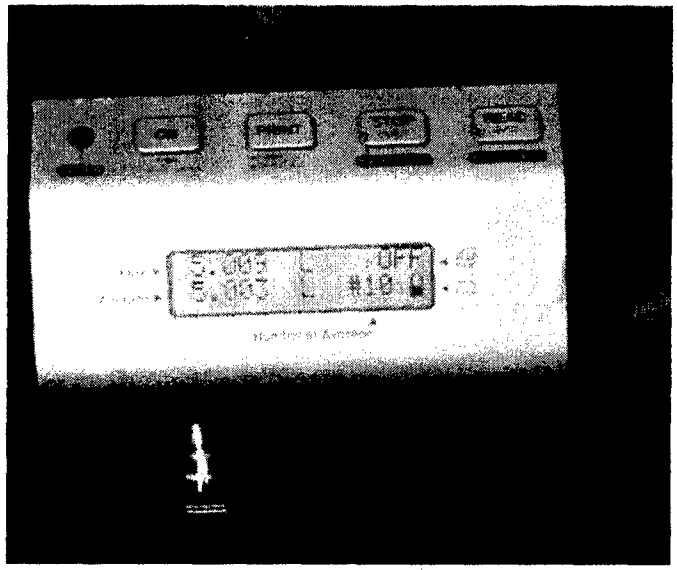
- **Setup**: Ensure sampling ***filter*** and appropriate ***impactors*** (greased) are in place. The hose to the calibrator should be attached to the bottom port. Inspect for kinks in the lines or any other obstruction in the calibration train.

- **Leak Test**: Upon train setup:

Press the calibrator's **ON** button.
Press **ON/AUTO/OFF** on the Minivol's control panel to manually turn on the pump. Check for any restrictions.
Place your thumb or other seal over the open end of the calibrator's intake. The sampler should stop operating within 5-10 seconds. If it does not, check the seal and, if necessary, the sampling train for leaks. To isolate leaks, disassemble the train at each connection, starting with the calibrator, and perform a leak check at each step as you work your way back. Example: pull the hose off the BIOS calibrator and seal the hose opening. Restart the sampler. If the leak check passes, the problem is the hose/calibrator connection or the calibrator itself. If it fails, continue moving through the train, sealing off each connection until you isolate the leak.



Calibration Procedure: You should familiarize yourself with the BIOS DryCal DC-Lite calibrator (starting on page 5 of the calibrator instruction brochure provided). Once the leak test passes:



1. Press the "READ" button on the BIOS™ calibrator to read the sampling rate in lpm (**observe the FLOW, not the AVERAGE**). The "**READ**" button must be pushed once each time to observe an instantaneous flow reading (or, press and hold the button to iniate the "AUTO" mode, which provides a new reading every few seconds).

2. Adjust sampler flow rate by turning the **FLOW ADJUST** knob on the sampler

control panel. Adjust to 5 lpm +/- 2% (+/- 0.1 lpm). This equates to an acceptable range of **4.90 – 5.10** lpm. **Disregard the indicated rotameter reading.**

3. Once individual readings indicate 5 lpm (+/- 0.1 lmp), press the "READ" button 10 consecutive times (or allow the "AUTO" mode to sequence through 10 readings). Observe the ***average*** for all 10 readings. If the average is within the acceptable range, calibration is successful.

4. For official field calibrations, **record the average as the initial flow rate**. If the average is outside the threshold, readjust the flow rate accordingly until the average of 10 consecutive readings is within 4.9 – 5.1 lpm.

4.3 SAMPLING ROUTINE

24-hour sampling runs will generally be conducted at 6-day intervals. AFIERA will provide instructions regarding any changes to sampling routine.

4.3.1 Pre-sampling

If the sampler is to be operated by battery, **the Minivol battery must be fully charged prior to sampling.** The calibrator should also be charged. Once the instrument passes the operational and calibration checks in a clean area:

1. Record preliminary information on the Field Datasheet (i.e., date, location, sample no., etc.).
2. Detach calibration train and the filter assembly from the sampler.
3. Place filter/impactor assembly in a **clean** plastic bag (e.g., zip lock) with a **clean rain cap.**
4. Reinsert control panel into the instrument housing for transport.
5. Transport *filter/impactor assembly* and *calibration train* in a suitable protective carrier, e.g., carrier cases that accompanied the new instrument. Bring Field Datasheet.

4.3.2 Field Procedures

At field location, carry out the steps below before sampling. Procedures should be performed in an area relatively free from the elements. If necessary, carry them out within a vehicle.

Remove control panel from instrument housing. **Do not detach power cord. Grasp unit by top cap, not circuit board; place panel on lip edge, and support against wall/structure.**
Attach filter/impactor assembly and calibration train to the instrument.

Start pump by pressing the ON/AUTO/OFF button on the control panel.

Leak check sampler.

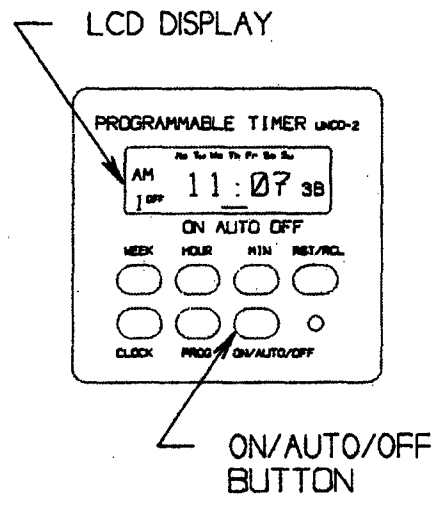
Calibrate to **5 lpm** +/- 2% (avg. over ten consecutive readings) under ambient conditions

Record average (AVG) flow rate on the Field Datasheet.

Turn off sampler, record reading from **Elapsed Time Totalizer** LED (next to AA battery).

Set **Real Time Clock** (if necessary): Personnel should synchronize their watch with the instrument clock.

- DAY SET: While holding down **CLOCK** button, press **WEEK** button until correct day appears at top.
- TIME SET (Hour): Hold down **CLOCK** and press **HOUR** until display indicates correct hour (you may need to cycle through hours to obtain proper **AM/PM**).
- TIME SET (Minutes): Hold down **CLOCK** and press **MIN** until the display indicates correct minutes. Seconds will automatically reset to zero.



Set **Timer**: (It is recommended that the timer be set up at the field location)

9.1 **Set new on/off times.**

9.1.1 Press **PROG** once. 1^{on} will appear in the lower left corner.

9.1.2 Press **HOUR** and **MIN** to set desired start time. **Note the correct AM/PM.**

9.1.3 Press **WEEK** to select day of the week (i.e., Mo, Tu, We, Th, Fr, Sa or Su). When more than one day is displayed, these days will all have the same power-on time.

9.1.4 Once the **program-on** time is set for the first cycle, press **PROG** again to set **program-off**. 1_{off} will now appear. Again press **HOUR**, **MIN**, and **WEEK** buttons in sequence to set those parameters and complete the first cycle. **Note the correct AM/PM.**

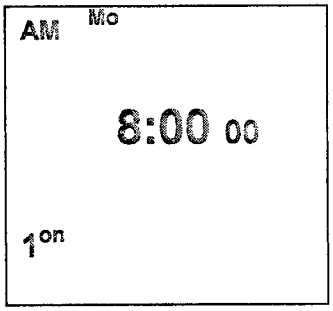
Normally, only one cycle will be necessary. All subsequent cycles (2 – 6) should be clear.

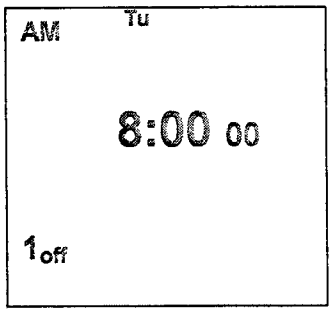
9.2 **Clear unwanted entries.**

9.2.1 Once Cycle 1 is set up, press **PROG** to toggle through each of the remaining cycles (2 - 6). If a start or stop time is observed in these cycles, press **RESET** ***once*** to clear the entry (a cleared entry is signified by four dashes in place of the time). **(Note: Pressing the RESET button again will recall, or reinsert the time just cleared!)**

9.2.2 Verify correct program entries for all 12 entry locations by pressing **PROG** to toggle through the 6 on/off cycles.

Your entries for cycle 1 should look similar to the following example:





Press CLOCK to return to the real-time clock display.

11. Press ON/AUTO/OFF button until the bar on the lower edge of the display is above the "**AUTO**" legend. The timer is now set.

12. Reinsert Control Panel into the instrument housing. The instrument is now ready to sample. (Placement/mounting instructions can be found in **Section 4.4, SITING**)

4.3.3 Post-sampling

Potential for change in sample mass due to particle loss, passive PM deposition, and damage to the filter increases between end of sample run and processing of filter. Therefore, **personnel should arrive at the sample location before the end of the sample run so that the filter can be processed immediately after sampling.** At the completion of the sampling run:

1. Remove sampler from mounting pole to a relatively clean, nearby area out of the elements. Maintain the sampler/filter assembly in an upright position at all times. Place on a firm, level surface.

2. Gently lift pump/timer assembly out of the unit and mount on the edge of the housing, preferably against a support structure such as a wall.

3. Check control panel for the Error Conditions below. Either condition results in premature pump shutdown. If an error condition exists, refer to the "Error Conditions" discussion at the end of this section for troubleshooting assistance.

   - **LOW FLOW** Indicator
   - **LOW BATTERY** Indicator

4. Verify elapsed time as shown on the **Elapsed Time Totalizer** at the top of the control panel to validate sampling event. If the time lapse is less than 24 hours, refer to the "Error Conditions" discussion at the end of this section.

5. Verify correct time and day on the time LCD to validate sampling event.

6. Record ending flow rate on Field Datasheet: remove rain cap, attach calibration train, and press **ON/AUTO/OFF** twice to start pump. Record the **average** (AVG) of 10 consecutive readings.

7. Detach Filter Assembly and carefully place into a clean zip lock bag for transport to filter processing area (clean area). **Every attempt should be made to keep the assembly in an upright position throughout the handling, transportation, and processing steps.**

Filter Recovery

8. In a clean area, carefully remove filter and place in appropriately numbered petri dish, ***rough side up.*** Close the dish immediately and secure with rubber band. Store upright. Refer to Section 4.1.3, "Filter Handling", for handling procedures, precautions, and packing/shipping instructions.

9. Complete *Field Datasheet* and *Meteorological Records* as described in section 4.5, "RECORDKEEPING".

10. Prepare for the next sampling event. Refer back to section 4.1.2, "Filter Assembly and Impactor Preparation" to prepare for the next sampling event.

Error Conditions

LOW BATTERY Indicator ON

Observe the total elapsed sampling time (Elapsed Time Totalizer) to determine the length of the sampling run before the sampler turned off. If the sampler operated for at least a few hours of time, the likely problem is the battery was not fully charged. Switch to the fully charged backup battery to complete the scheduled sampling event while recharging the first battery according to the manual's directions. If the second sampling attempt is successful, try the first battery again for a 24-hour period, this time in or near the office/lab area. If the problem reoccurs, the battery is defective and will need to be replaced. If both batteries have similar problems, it could be the AC source, or the instrument's pump is operating at an abnormally high rate throughout the sampling period to compensate for a restriction somewhere in the sampling chain. One other problem could be a pump that is drawing an abnormal amount of current. Determining whether the source of the problem is the battery power or the sampler can be accomplished by trying the batteries out in another sampler.

LOW FLOW Indicator ON

Do not confuse this indicator light with the THRESH indicator light, which normally lights whenever the sampler is attached to a power source but is not operating.

Observe the total elapsed sampling time. If the battery is O.K., the problem may be due to an **Air Restriction** in the impactor inlets, filter holder (e.g., overloading of filter, wet filter, etc.), or tubing (crimps). Loose or broken tubing on the *outlet* side of the pump could also cause a low flow condition.). A **Pump Malfunction** could result in a low flow condition, which is usually caused by damaged or contaminated pump head components (valves, diaphragms). Determining whether the problem is within the filter assembly or the sampler can be accomplished by operating the sampler with the assembly both connected and disconnected. For pump maintenance instructions, see Section 7 of the manufacturer's technical manual.

Overriding Low Battery/Low Flow Indicators

When these indicator lights are on, pressing the RESET button on the control panel can restart the instrument. Pressing and holding the switch provides continuos override of the fault circuit, when needed to troubleshoot the instrument.

Additional Troubleshooting

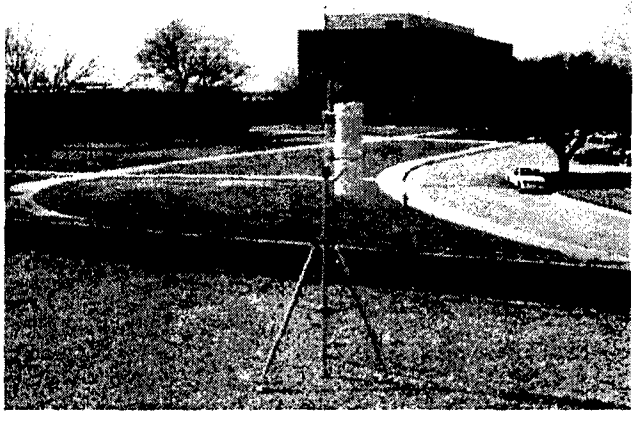
Other problems that can be encountered and their corrective actions can be found in **Section 8, page 57** of the manufacturer's technical manual.

4.4 SITING

Do not **site the instrument adjacent to obvious air emission sources, such as industrial processes, generators, fueling and fuel storage areas, vehicle or aircraft maintenance and operating areas, any type of stack or vent, refuse or other waste sites, etc.**

Do **site the instrument:**

- at or near the center of the base population
- in an area that provides easy access and security from tampering
- in a relatively open area in which nearby buildings/structures do not impede natural air flow
- with the *air inlet* at a height above the ground between 2 – 15 meters (**6.5 – 49 ft**)
- with the *air inlet* at a height above the supporting surface of 2.0 m +/- 0.2 m (**6 – 7 ft**)
- with the *air inlet* at least 1 m (**3.25 ft**) away from the nearest wall, structure, or other obstacle to air flow (preferably much more)



Low-story roofs often provide an adequate measure of security and representative monitoring. The sampler inlet must be above the height of any wall or barrier surrounding the area.

Obtain GIS coordinates of the site. Ask a local GIS-equipped unit to provide assistance. Sample Latitude and Longitude in both degrees and minutes. This information is required on PM Sampling Datasheets. *Note:* **Check to ensure that accuracy of GIS does not make coordinates classified.**

Additional Precautions:

- **The pole will likely require additional support in areas susceptible to high winds/tip-over**
  - Mounting brackets are located on the bottom of each tripod leg, along with screws, to secure the tripod to the roof or appropriate surface once adequate siting is accomplished; bracing with rope or other means of support may also be considered
- **The top of the inlet must remain horizontal during sampling; ensure the pole is straight and, if necessary, use tape to stabilize the sampler against the pole**

4.5 RECORDKEEPING And REPORTING

4.5.1 Field Datasheet

Complete a Field Datasheet for each sample and field blank (not trip blank). Review the sheets for completion before forwarding. The original datasheets will be placed in zip lock bags, packaged with the associated samples, and forwarded to the supporting lab, which may be CHPPM or AFIERA. Retain a copy on site and mail another copy to:

Deployment Environmental Surveillance

AFIERA/RSEW

2513 Kennedy Circle, Bldg. 180

Brooks AFB, TX 78235-5123

Field Datasheet – PM Sampling

Instructions

Preliminary Data

Installation: Self explanatory. **Base Code:** PSAB:*1242* / Al Jaber:*1237* / Esk Village:*1235*
Site Location: Describe area, e.g., "Building 28, barracks rooftop."
Geolocation: Original siting measurements. Provide Degrees and Minutes.
Date: Sampling start date.
Sample ID#: Dependent upon analytical support lab:
For **CHPPM**: XXX YYYY DDDDD ZZ

- **XXX** - First three letters of base/installation
- **YYYY** - Method type (PM10 or PM25)
- **DDDDD** - Jday code: last two digits of year and three digit Julian day (e.g., 00030 for 30 Jan 00)
- **ZZ-** Sample type: **P**-Primary sample; **C**-Collocated sample; **FB**-Field Blank; **TB**-Trip Blank

For **AFIERA**: XX XX XXXX

- **First two digits: EX**
- **Second two digits: Sample Year (00 for SY 2000)**
- **Last four digits: Numerically sequenced sample number for that base during the calendar year.**

The AFIERA Lab will also require AF Form 2750 *(3 samples per form) in place of*

the Field Datasheet. However, completion of the Field Datasheet is still required and must be forwarded to AFIERA/RSEW Deployment Environmental Surveillance.

Sample Type: Circle one—except for metals. Metals are sampled/analyzed in conjunction with PM10, PM2.5, or TSP. Circle "Metals" and the appropriate PM type.
Filter ID#: Fill in with pre-assigned numbers which accompany the filters from support Lab.
Instrument SN: MiniVol serial number.
Calibrator Mod/SN: Calibrator model and serial number.
Filter Assembly ID#: **Fill in with pre-assigned numbers from AFIERA DES.**

Operator: Sampler's name.
Contact Info: Sampler's E-mail address and Telephone number.
Signature: Sampler's signature.

Field Data

Pre-Sample

Leak Check: Fill in block with *Pass* upon successfully completing leak check. If failure at start, fix problem before initiating sampling.

Starting Flow Rate: Calibrated flow rate, i.e., 5000mL/min +/- 100mL (avg of 10 consecutive readings).

Sample Start Time: Normally the start time programmed into the timer, if used.

El. Time Totalizer: Record start reading from control panel after calibration.

Post Sample

Leak Check: If leak is identified within the sampler or the attached filter/impactor assembly—sample is invalid. If the leak is identified within calibration train—fix and re-test.

Ending Flow Rate: Post-sampling flow rate (average over 10 readings).

Sample Stop Time: Self explanatory.

El. Time Totalizer: Record *End* reading upon completion of sampling event—but before measuring ending flow rate. A valid sample time is between 23 and 25 hours.

Average Flow Rate: Average of Starting and Ending flow rates.

Total Sample Time: Record in Minutes. (e.g., 24 hrs x 60 min = 1440) Valid sample is 23 – 25 hours. Do not use the Elapsed Timer Totalizer readings for this.

Actual Volume, V_{act}: **Multiply the average flow rate (Q_{act}) x Minutes sampled.**

Background Notes: Include any information that could affect sampling results for this sample. Notable activities would include **increased aircraft/ vehicle operations**, or **other combustion processes** in the area during the sampling, significant **wind-blown dust events**, or any activity or event that could affect airborne particulate matter concentrations. Include any **unusual circumstances** and any other helpful information associated with the sample or sample period.

Lab Analysis **To be completed by CHPPM or AFIERA, depending on support lab.**

4.5.2 AF Form 2750

Only when the supporting analytical lab will be AFIERA, **an AF Form 2750 (3 samples per form) will also need to be accomplished and forwarded along with the samples. In this situation, mail the original Field Datasheet to AFIERA/RSEW Deployment Environmental Surveillance and maintain a copy of each form. CHPPM lab requires only the original Field Datasheet with the samples—no Form 2750 is required. Mail a Field Datasheet copy to AFIERA/RSEW Deployment Environmental Surveillance and retain a copy.**

4.5.3 Meteorological Data

Record the Meteorological Data for the beginning of the sampling period and at eight-hour intervals during the sampling event for a total of four readings. Include your observations over the event regarding visible emissions or odors. Meteorological information can be obtained from the local supporting Weather Station.

Appendix B
SUMMA Canister Sampling for Ambient VOCs – (TO 14A)

Excerpt Taken from USACHPPM DRAFT TG-251

APPENDIX 6-4
AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

Alicat Scientific® is a registered trademark of Alicat Scientific, Inc., Tucson, Arizona

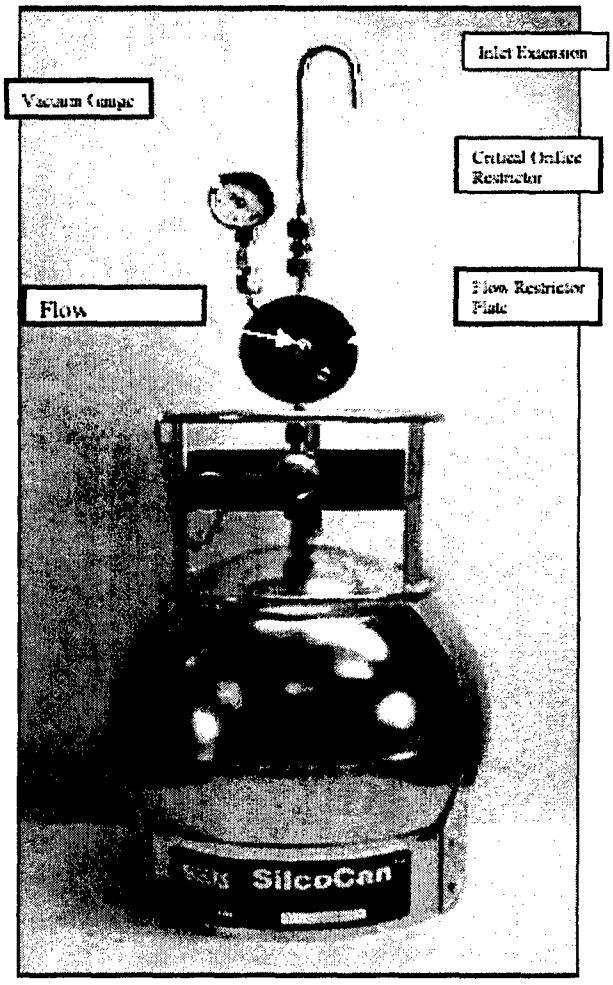


Figure 6-4-1. Assembled TO14 passive sampler.

6-4.4 REPLACING THE FRIT PARTICULATE FILTER

Perform the following steps in a clean environment that is protected from the weather. If possible, perform the following on a clean, level surface

1. Remove the sample inlet extension from the flow controller with a 9/16" wrench. If the swagelock nut on the critical orifice turns with the nut on the sampling extension outlet, grasp and hold it with a 1/2" wrench

2. Remove the old O-Ring and frit filter by turning the restrictor upside down and lightly, tapping it if necessary.

3. Replace the frit filter and O-ring with new ones using a pair of clean tweezers to prevent contamination. Do not handle the filter or O-ring with bare hands. The frit filter is installed first, then the O-ring (Figure 6-4.2).

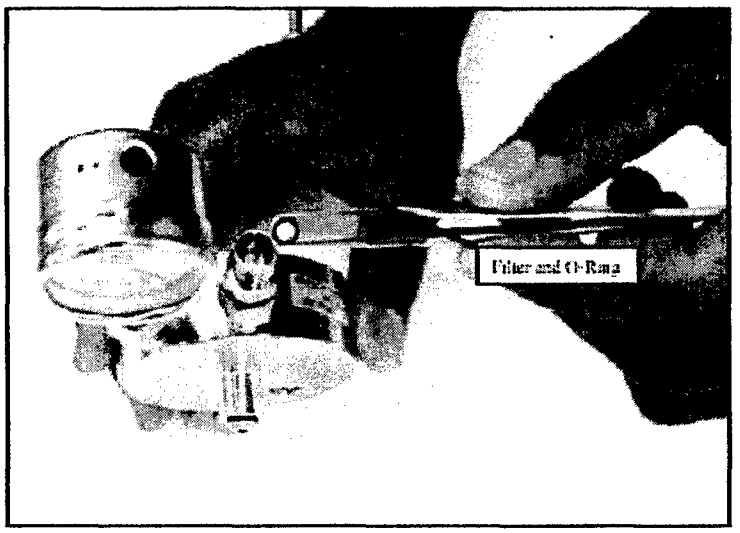


Figure 6-4-2 Installation of frit filter and O-ring into flow controller

4. Replace the sample inlet extension. Tighten the swagelock nut until firmly snug, but do not over tighten. If the swagelock nut on the orifice turns with the nut on the inlet, grasp and hold it with a 1/2" wrench.

5. Discard the used frit filter. The O-ring may be reused after cleaning it with water and inspecting it for cracks or tears (if necessary).

6-4.5 CALIBRATING THE RESTRICTOR FLOW RATE AND LEAK CHECK

1. Perform the following steps in a clean environment that is protected from the weather.

2. Note the critical orifice's code located on the top swagelock nut. Refer to Table 6-4-1 for the fill times and target flow rates for a 6 L canister.

Table 6-4-1 Fill Times and Target Flow Rates for a 6 L Canister

Critical Orifice PN	Stamp Code	Fill Time for a 6L Canister[1] (hours)	Target Flow Rate (ccm)
39-23010	1	1	80
39-23030	2	3	27
39-23080	3	8	10

39-23240	4	24	3.4
39-14010	5	1 week	0.5

[1]Fill time will be reduced by the ratio of ambient pressure to standard pressure (760 mmHg or 29.92 in Hg) or P_a / P_s.

3 Unscrew the swagelock cap on the practice canister inlet with a 9/16" wrench (Figure 6-4.3). Grasp and hold the canister inlet to prevent any movement.

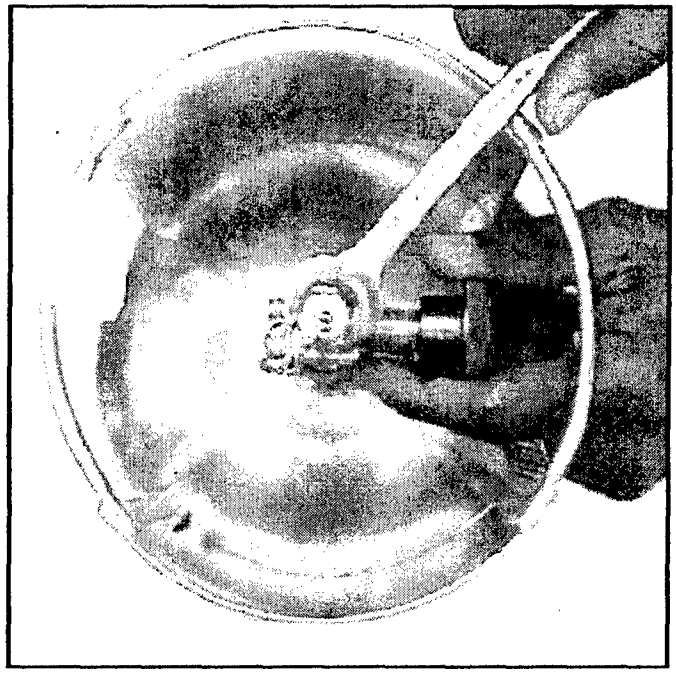


Figure 6-4.3. Removing swagelok cap from 6-L canister

4 Choose a restrictor that fills the 6 L canister in the desired time period using Table 1 and the restrictor stamp code.

5 Remove the sample inlet extension of the restrictor using a 9/16" wrench. Use a 1/2" wrench to hold the swagelock nut of the critical orifice restrictor in place as shown in Figure 6-4.4

Excerpt Taken from USACHPPM DRAFT TG-251

APPENDIX 6-4
AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

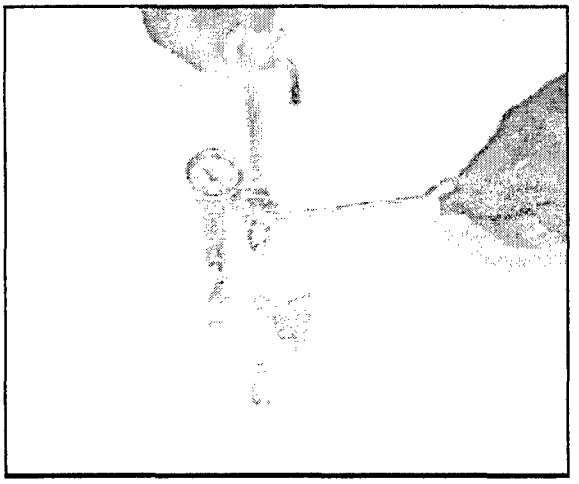


Figure 6-4.4 Removing sample inlet extension

6 Connect the restrictor outlet to the inlet of the evacuated practice canister as shown in Figure 6-4.5. Grasp the canister inlet with a free hand while tightening the swagelock nut on the restrictor outlet until firmly snug. Do not over tighten the swagelock nut.

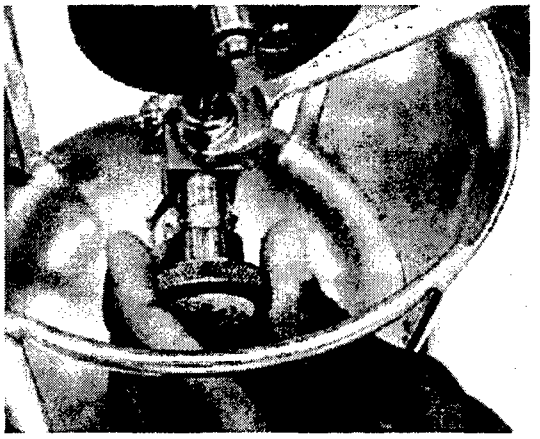


Figure 6-4.5 Attaching flow restrictor to canister

7 Connect the outlet of the Alicat flow check device to the inlet of the restrictor as shown in figure 6-4.6. The arrow on the Alicat device should be pointing toward the canister. Tighten the swagelock on the outlet of the Alicat® with a 9/16" wrench until firmly snug. If the swagelock nut on the inlet of the restrictor turns with the swagelock nut on the outlet of the Alicat, grasp the swagelock nut on the restrictor inlet with a 1/2" wrench and hold.

There is only one way for the Alicat to attach to the inlet of the restrictor Note There is only one way for the Alicat to attach to the inlet of the restrictor

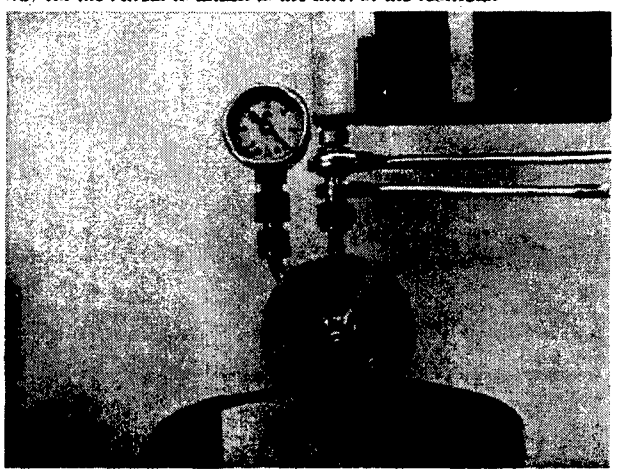


Figure 6-4.6. Connecting Alicat flow check device to flow restrictor

8 Turn on the Alicat.

9 Press the zero button on the face of the Alicat until a zero is displayed on the digital screen

10 Open the canister valve and wait 30 seconds or until the flow stabilizes

11 Cover the inlet of the Alicat until the flow stops (a zero is displayed on the digital screen)

12 Close the canister valve and wait 5 minutes

13 Uncover the inlet of the Alicat If the flow fails to start, a leak exists in the flow path. Carefully retighten the swagelock nuts and repeat steps 11 through 14 until there are no leaks detected.

14 Open the canister valve and wait 30 seconds or until the flow stabilizes

15 Remove the outer protective screw located on the center of the flow restrictor's face using the 1/8" hex key as shown in Figure 6-4 7 The flow set screw is recessed under this protective screw.

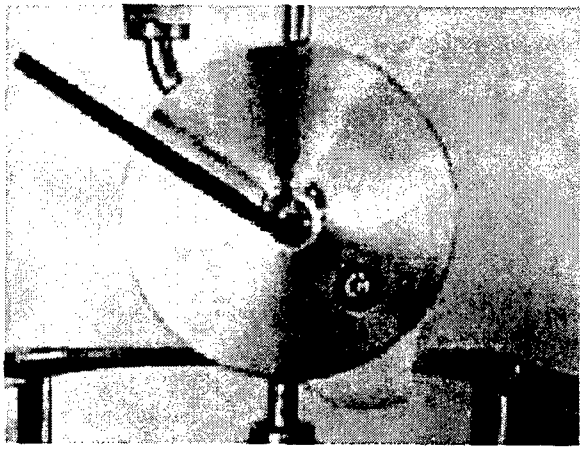


Figure 6-4.7. Removing protective cover for flow set screw

16 Slowly adjust the set screw with the 1/8" hex key until the flow rate as measured by the Alicat is as close as possible to the target flow rate listed in Table 6-4-1 (note the stamped code on the restrictor, see diagram below). **DO NOT** turn the set screw more than 3 turns. The internal diaphragm can be damaged by over tightening!

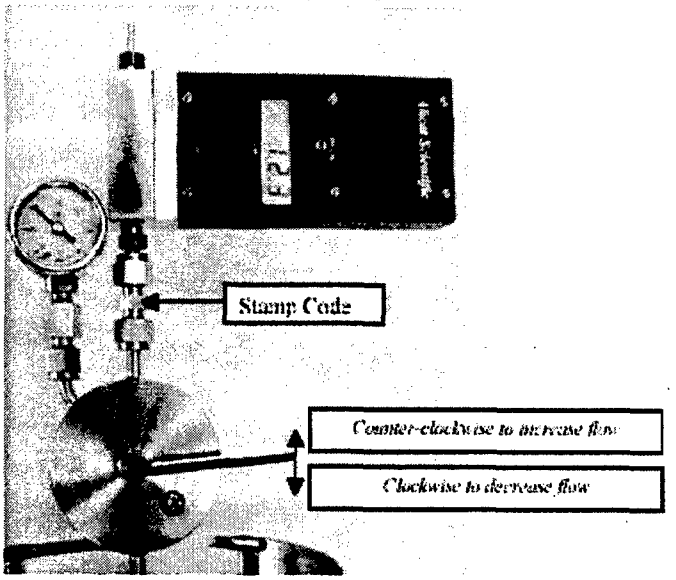


Figure 6-4.8. Adjusting flow set screw in restrictor plate

17 Wait 30 seconds until the flow rate stabilizes.

18 Record the measured flow rate in cubic centimeters per minute (ccm) and the serial number of the restrictor in the sample data sheet.

19 Close the practice canister's inlet valve and tighten to prevent leakage.

20 Replace the outer protective screw on the flow restrictor's face and tighten until firmly snug.

21 Unscrew the swagelock nut on the outlet of the Altest and remove it.

22 Unscrew the swagelock nut on the outlet of the restrictor and remove it.

23 Reinstall the sample inlet extension on the restrictor. Tighten the connecting swagelock nut on the sample inlet extension until firmly snug.

24 Replace the black plastic cap on the sample inlet extension.

25 Store the flow restrictor in a plastic bag or wrap with aluminum foil until ready for field use to prevent contamination.

26 Repeat the above process for the each of the remaining flow restrictors.

27 Replace the swagelock cap on the practice canister and tighten until firmly snug when finished. Do not over tighten and avoid moving the canister inlet when tightening the swagelock cap.

NOTE: If the barometric pressure differs from standard conditions (760 mm Hg or 29.92 in Hg) significantly, the sample period or flow rate will have to be modified to prevent premature filling of the canister (a canister with a zero vacuum has reached atmospheric pressure and is to be considered suspect). This is especially true in mountainous areas with high elevations. Either the sample period or the sample flow rate will need to be *reduced* by a factor of P_a/P_s where P_a is the average ambient barometric pressure and P_s is the pressure at standard conditions. For example, if the average ambient barometric pressure is 650 mm Hg, either the flow will need to be reduced *or* the sample period will need to be reduced by 650/760 = 0.85. Either the target flow rate or the sample period would then be multiplied by 0.85. If possible, the canisters should be monitored during the sample event to prevent them from reaching 0 vacuum or atmospheric pressure.

6-4.6 PRESAMPLING PROCEDURES

1 Prior to mounting the canister, perform the following steps in a clean environment that is protected from the weather.

2 Choose the flow restrictor that will fill the 6 L canister in the desired time period. Calibrate the restrictor using the steps in Section 6-4.6, noting the stamp code on the top swagelock nut at the restrictor's inlet.

3 Remove the swage cap from the sample canister. Grasp and hold the canister inlet with a free hand and do not allow the inlet to move.

4 Remove the flow restrictor from the protective plastic bag or aluminum foil.

5 Connect the outlet of the restrictor to the inlet of the 6 L sample canister. Tighten the swagelock nut on the restrictor outlet until firmly snug. If the canister inlet turns with the nut on the outlet of the restrictor, grasp and hold it with a free hand. Do not over tighten.

APPENDIX 6-4
AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

6 Choose a sampling site that will properly assess the content of VOCs in the ambient air. Normally, a sampling location will not be very close to a pollution source, but a certain distance away in order to assess the ambient air in the "vicinity" of the source.

7 Remove the black plastic cap from the sample inlet and place in the protective plastic bag or in the aluminum foil (don't lose it)

8 Open the canister inlet valve all way, then turn ¼ turn back.

9 Record the initial reading displayed on the vacuum gauge in the data sheet

10 Mount the canister so that the sample inlet is at a height of approximately 6 feet from the ground (i.e. in the breathing zone), unless otherwise specified. The site should generally be a certain distance from obstacles such as buildings or trees to avoid air turbulence generated by them. If no mounting hardware is available, the canister may be placed on a level, horizontal surface during the sample event. If rain is expected to occur during the sample event, shield the sample inlet extension so that it will remain dry.

11 Shield the canister from direct sunlight using a sheet of cardboard, for example. Direct sunlight (especially in a desert environment) will heat the air collected inside the canister above the ambient temperature, thereby reducing the pressure difference between the canister and the ambient atmosphere. This results in a reduction in the total volume of air collected and will risk premature filling of the canister.

12 Record the following information in the data sheet

- Initial vacuum gauge reading. The vacuum gauge should display approximately 29 in Hg vacuum
- Ambient temperature (Measure the ambient temperature of the air away from direct sunlight)
- Wait 5 minutes and record the ambient barometric pressure displayed on the portable barometer
- Initial flow rate from the calibration procedure
- Sample date
- Initial start time
- Name of the sampling location, including the following:
- Country
- MGRS location (10 digit)
- Canister serial number
- Flow restrictor serial number
- Current weather conditions and any other relevant information in the remarks section of the data sheet. The location of nearby sources or polluting activities should also be recorded in the data sheet

6-4.7 POST SAMPLING PROCEDURES

1 Remove the canister from where it was mounted

2 Record the final vacuum gauge reading in the data sheet. If the canister vacuum has reached less than 1 in Hg, the sample period may need to be shortened or the flow rate reduced.

3 Close the canister inlet valve tight.

4 Replace the black plastic cap on the sample inlet extension.

5 Record the following information in the data sheet.
- Stop time
- Sample duration
- Ambient Temperature (Measure the ambient temperature of the air away from direct sunlight)
- Wait 5 minutes and record the atmospheric pressure displayed on the portable barometer
- Current weather conditions (in remarks section)
- Any active pollution sources nearby (in remarks section)

6 Perform the following steps in a clean area protected from the weather.

7 Unscrew the swagelock nut at the outlet of the flow restrictor with a 9/16" wrench to remove it from the canister inlet. If the canister inlet turns with the swagelock nut on the restrictor's outlet, grasp and hold it with a free hand

8 Screw the swagelock cap on the canister inlet and tighten with a 9/16" wrench until firmly snug. Grasp and hold the canister inlet to prevent it from moving. Do not over tighten.

9 Place the flow restrictor in a sealable plastic bag or wrap in aluminum foil to prevent contamination

10 Store the canister in a area until shipment.

6-4.8 MEASURING FINAL RESTRICTOR FLOW

1 Perform the following steps in a clean environment that is protected from the weather.

2 Remove the restrictor from its protective bag or aluminum foil

3 Attach the restrictor to the practice canister as described in CALIBRATING THE FLOW RESTRICTOR

4 Remove the sample inlet extension

5 Connect the Alicat to the inlet of the flow restrictor

6 Turn on the Alicat

7 Press the zero button on the front face until a zero is displayed on the digital screen. The assembly should look like the following figure.

Excerpt Taken from USACHPPM DRAFT TG-251

APPENDIX 6-4
AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

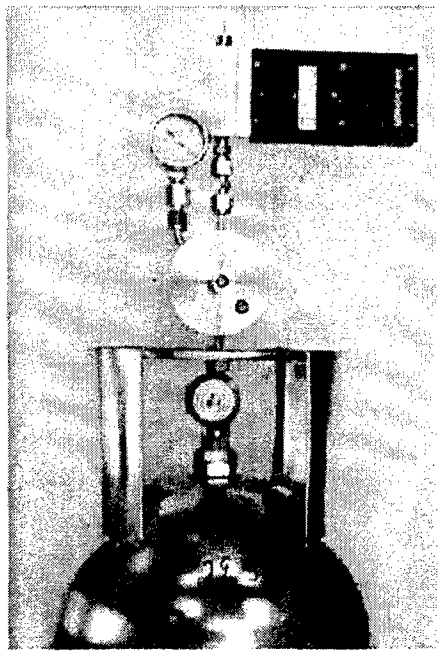


Figure 6-4-9 Measuring post flow rate using practice canister

8 Open the practice canister's inlet valve all the way. Make sure the vacuum gauge reads at least 5 in Hg

9 Cover the inlet of the Alicat until the flow reaches zero.

10 Close the canister inlet valve and wait 5 minutes.

11 Uncover the Alicat inlet. If the flow rate remains zero, there is a leak in the system. Inspect for leaks and tighten any loose swagelocks. Repeat steps 7 through 10 until no leaks are detected

12 Open the canister inlet valve and allow the flow rate displayed on the Alicat to stabilize.

13 Record the final flow rate displayed on the digital screen of the Alicat® in the data sheet

14 Close the canister inlet valve.

15 Remove the Alicat

16 Replace the sample inlet extension on the flow restrictor. Make sure the O-ring and frit filter are still in place at the inlet of the restrictor

17 Remove the flow restrictor from the canister inlet

18 Place the flow restrictor in a protective plastic bag or rewrap in aluminum foil.

19 Repeat this process for each flow restrictor used during a sample event

20. Turn off the Aliquot when finished.

6-4.9 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

1. Note in the data sheet if a sample canister has reached atmospheric pressure (0 in Hg on the vacuum gauge).
2. Ensure all field in the data sheet are complete.
3. Enter field data sheet information into "Deployment Environmental Surveillance Database", if applicable.
4. No field blanks are required for the TO-14A method, unless specified.
5. Note in the data sheets which canisters are being used as background samples, if applicable.
6. Use caution when using VOC containing fluids near the canisters.

6-4.10 ERROR CONDITIONS

1. Loss of vacuum during canister storage. This is an indication the sample has been contaminated. Note serial number and error in a data sheet for the canister.
2. Flow controller failure has occurred if the flow rate does not change while the set-screw is turned more than once. Label the controller and do not use.
3. If the canister has reached atmospheric pressure (0 in Hg as displayed on the vacuum gauge), note this in the data sheet.

Excerpt Taken from USACHPPM DRAFT TG-251

APPENDIX 6-4

AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

USACHPPM-DESP *A-TO14-FDS-V1.1*

Air - TO14 Field Data Sheet

Section I - Administrative Data		
1. Sample ID:*	*7. Collected By*:*	*11. Lab ID:*
2. Location:	*8. Unit Spec ID:*	*12. Job No:*
3. Country:	*9. Mission ID:*	*13. Project No:*
4. Operation:	*10. Shipping ID:*	*14. Europe ID:*
5. Sampling Date:*	*15. Sample Notes:*	
6. Sampling Time:*		

Section II - Field Data		
16.Collectors Name:*	*19. Certification Date*:*	*22. Fill Time*:*
17. Collectors Phone No:*	*20. Flow Calibrator ID*:*	*23. Set Flow*:*
18. Canister ID:*	*21. Flow Adapter ID*:*	*24. Invalid Sample?:*

SAMPLER DATA	*Start/Pre*	*End/Post*	*Average*
25. Date:*			
26. Time:*			
27. Ambient Temperature (oC):*			
28. Ambient Pressure (inHg):*			
29. Canister Pressure (in Hg):*			
30. Flow Rate (cc/min):*			
31. Sample Time (min):		*= End Time - Start Time*	
32. Volume (liters):		*= Sample Time (min) * Avg Flow Rate (cc/min)*	

GEOLOCATION	*Decimal Degrees*		*33. MGRS*:*
33. Latitude:*		*OR*	
34. Longitude:*			
36. Field Notes:*			

Excerpt Taken from USACHPPM DRAFT TG-251
APPENDIX 6-4
AMBIENT AIR VOLATILE ORGANIC COMPOUND (VOC) SUMMA CANISTER SAMPLING (TO-14A)

AIR - VOC TO14 SAMPLING DATA SHEET INSTRUCTIONS

SECTION I - ADMINISTRATIVE DATA

1 **Sample ID** - Sample ID number XXX_YYYY_DDDDD_ZZ
    Where: XXX - Camp abbreviation (i.e. first three letters of camp name)
    YYYY - Media type (e.g. TO14)
    DDDDD - [illegible]
    ZZ - Sample type: **P** - Primary sample, **C** - Collocated sample, **FB** - Field Blank, **TB** - Trip Blank
2 Location - Camp or location of sample
3 Country - Country in which location or camp is located
4 **Operation** - Name of operation ongoing in the area of the sample (e.g. Operation Allied Force (OAF), etc.) if applicable
5 **Sampling Date** - Date sample was collected (e.g. 31-Jan-2003)
6 **Sampling Time** - Time sample was taken (e.g. 16:00)
7 **Collected By** - Unit collecting the sample (e.g. [illegible], etc.)
8 Unit Spec ID - Unit specific ID associated with the sample if any
9 Mission ID - Unit mission ID associated with the sample if any
10 Shipping ID - Shipping ID associated with sample (e.g. Fedex tracking number)
11 LAS ID - Unique ID number assigned at CHPPM-Main laboratory, if applicable
12 Job No. - Job number assigned at laboratory
13 Project No. - Project number assigned by laboratory or project officer
14 Europe ID - Unique ID number assigned at CHPPM Europe laboratory, if applicable
15 **Sampling Notes** - Any notes or comments associated with the sample (e.g. short holding time, unusual circumstances, etc)

SECTION II - FIELD DATA

16 **Collectors Name** - The name of the person collecting the sample
17 **Collectors Phone No** - The phone number of the person collecting the sample
18 **Canister ID** - Unique ID off of canister or canister tag
19 **Certification Date** - Date canister was certified laboratory clean
20 **Flow Calibrator ID** - Unique ID off of flow calibrator
21 **Flow Adapter ID** - Unique ID off of flow adapter
22 **Fill Time** - Fill time for particular flow adapter (e.g. 8-hour, 24-hour, 1-week)
23 **Set Flow** - The set flow from the Flow Adapter sheet for a particular sampling duration
24 **Invalid Sample** - Was the sample determined to be invalid? If so, why?
    No - Sample is valid (*default if entry is left blank*)
    M - Missing Field Data - e.g. sample time, flow rates, etc.
    B - Battery Failure - battery failed during sampling episode
    F - Flow Differential - pre and post flow calibration deviation was greater than 10%
    T - Timer Malfunction - pump timer failed
    S - Sample Malfunction - other part of sampler failed, e.g. tubing, etc
    D - Damaged Sampling Media - sampling media was damaged during shipment or sampling episode
25 **Date** - Date which the sampling episode was started and ended - DD-MON-YR - (e.g. 01-Jan-03)
26 **Time** - Time which the sampling episode was started and ended in 24 hour standard (e.g. 14:30)
27 **Ambient Temp** - Ambient Temp in degrees Celsius from thermometer at the start and end of the sampling episode
28 **Ambient Pressure** - Ambient pressure in inches Hg from barometer at the start and end of the sampling episode
29 **Canister Pressure** - Canister pressure in inches of Hg from flow adapter at the start and end of the sampling episode
30 **Flow Rate (cc/min)** - Flow rate in cc/min from flow calibrator at the start and end of the sampling episode
31 **Sample Time (min)** - Time the canister collected sample, from the start and end time.
32 **Volume (liters)** - Volume of sample collected in liters. (*Calculated*) - [Volume = (Sample Time * Average Flow Rate) / 1000]
33 **Latitude** - Sample latitude location in decimal degrees from GPS
34 **Longitude** - Sample longitude location in decimal degrees from GPS
35 **MGRS** - Location in MGRS from GPS, eight to ten digit grid with grid square identifier (e.g. [illegible])
36 **Field Notes** - Notes relating to sampling episode (e.g. unusual circumstance, weather, potential pollution sources, etc)

Appendix C
PS1 Sampling Instructions - (TO-14A)

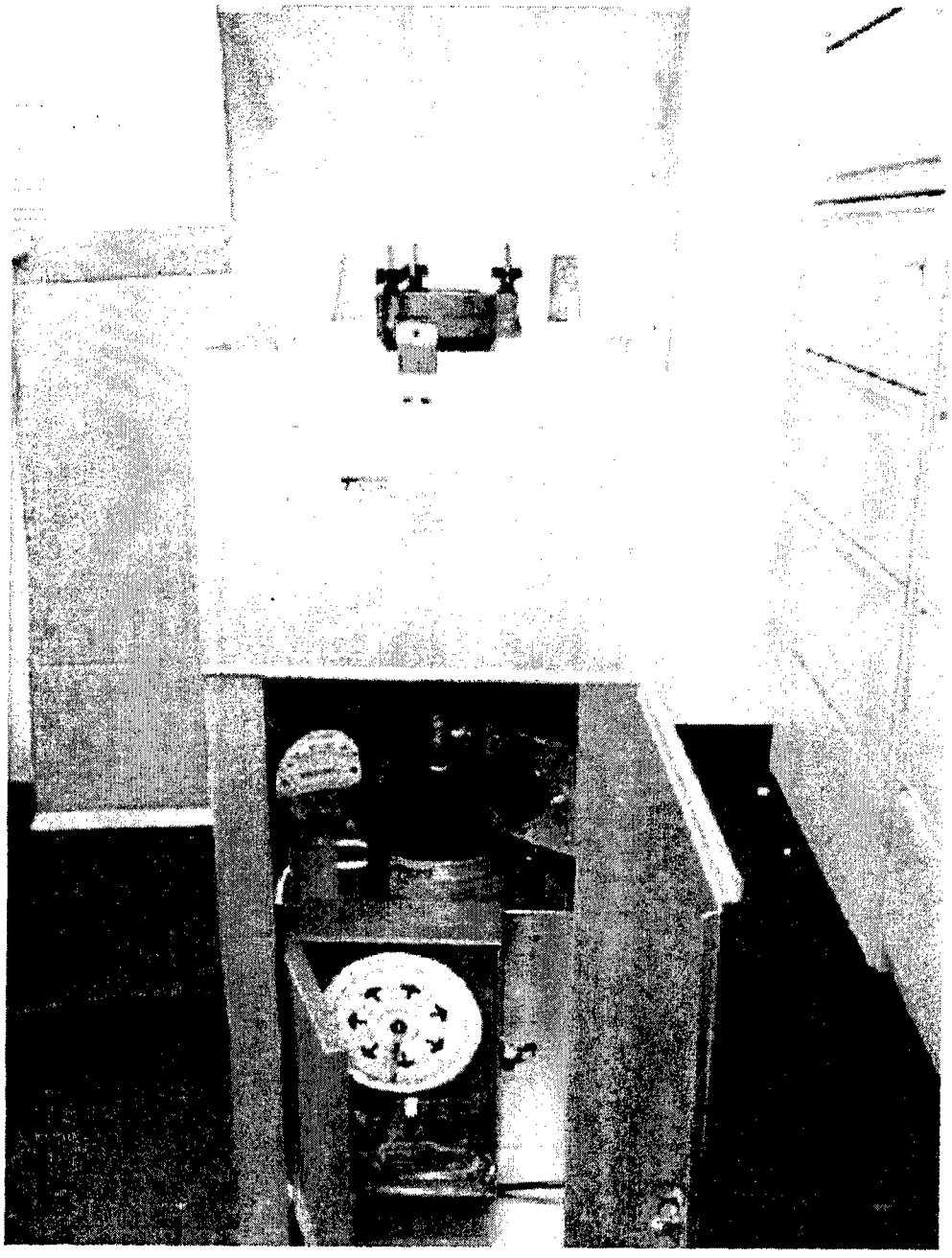


Figure 6-5-1. PS-1 Sampler.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

6-5.4 PS1 SAMPLE MODULE PREPARATION

Sample module set-up and recovery should be accomplished in a clean controlled environment. *Avoid transporting sample modules containing cartridges for long distances. Sample cartridges should be placed in the sampling module as close to the sampling site as possible and just prior to beginning a sampling event to prevent minimize contamination.*

1. Disassemble the sample module as shown in Figure 6-5-2.

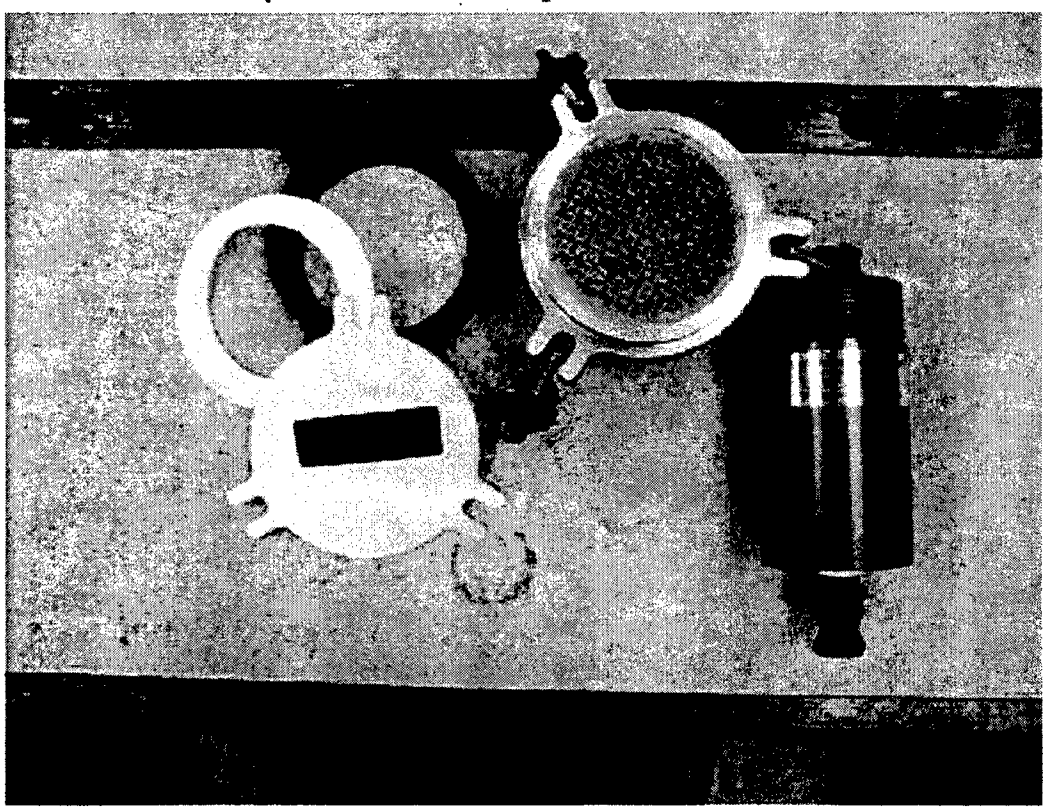


Figure 6-5-2. Disassembled sample module ready to be rinsed with Hexane.

2. Rinse each piece of the sample module with the reagent grade hexane contained in a Teflon squeeze bottle (see Figure 6-5-3).

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

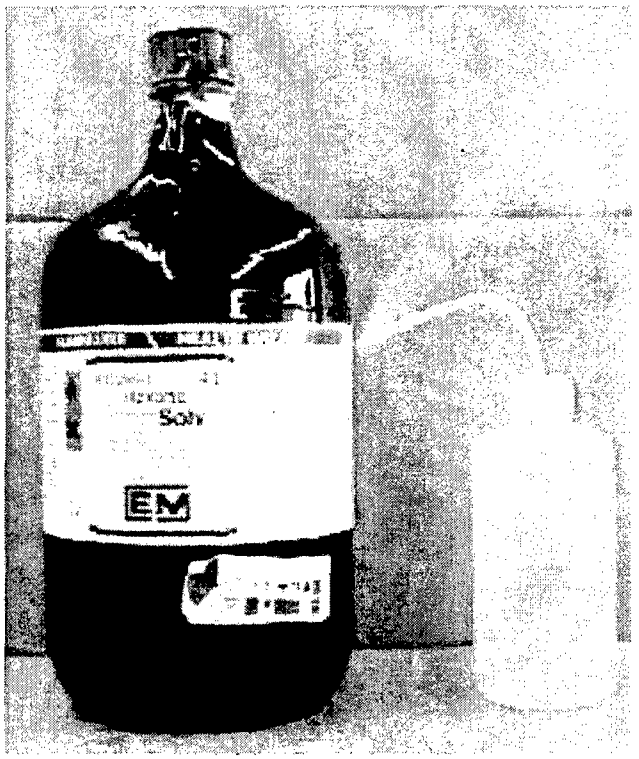


Figure 6-5-3. Reagent hexane and teflon bottle.

3. Affix a numbered sample label to the shipping container (if one is not already present).
4. While wearing gloves remove the sample cartridge from the shipping container.
5. Remove the protective aluminum foil wrapping from around the sample cartridge and place aluminum foil back into the shipping container. Place lid back on the container.
6. Install sample cartridge into the bottom of the sample module (make sure a PTFE gasket is located between the inside bottom of the sample module and the sample cartridge bottom. There should be another PTFE gasket that seals the top of the cartridge to the bottom of the sample module top, also).
7. Screw sample module top on to sample module bottom. Tighten until the top is hand tight. Caution: Over tightening the module can break the glass sample cartridge.
8. Place one of the hexane rinsed white teflon gaskets on the filter support screen.
9. Using Teflon tipped tweezers, remove a 102 mm glass fiber filter from the filter container and install it on top of the white hexane rinsed teflon gasket.
10. Place the second hexane rinsed white teflon gasket on top of the glass fiber filter.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

11. Install the filter hold down ring and then the sample module cover plate on the sample module.
12. Hand tighten the three finger nuts.
13. Install a clean piece of aluminum foil around the sample module inlet connector. Figure 6-5-4 shows how the sample module should appear by now.

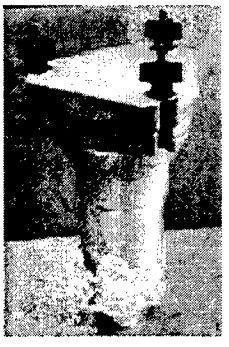


Figure 6-5-4. Assembled sample module

14. Using tape, mark the sample module with the *Media Id* obtained from the shipping container. Use a ball point pen or pencil, but do not use a marker (markers may contribute to background levels of analytes).

6-5.5 PS1 SAMPLING FIELD SET-UP

1 Record the following information on the "PS1 Data Sheet" (See Section 6-5.11)

- *Sample ID* - - Sample ID number XXX_YYY_DDDD_ZZ

  Where:

  XXX - Camp abbreviation (i.e. first three letters of camp name)

  YYY - Method type (e.g. TO13, TO9)

  DDDD - jday code, first digit is the last number of the year and remaining three digits are the jday of the year.

  ZZ – Sample type:

  P – Primary sample, if collocated

  C – Collocated sample, if collocated

  FB – Field Blank

  TB – Trip Blank

- *Location* –Sampling location.
- *Operator* – Name of person conducting the sampling

- *PS1 Type* – Type of PS1 sample TO-13, TO-9, or TO-4
- *Sampler ID* – Serial number of the sampler
- *Calibration ID* – Unique ID of associated calibration (from "PS1 Calibration Sheet")
- *Media ID* – Media ID number. If shipping container is not numbered then assign a unique ID to the sampling media.
- *Pre-Ambient Temperature* – Pre-sampling ambient temperature in degrees Celsius (°C) from the thermometer.
- *Pre-Ambient Pressure* – Pre-sampling ambient barometric pressure in inches of mercury (in Hg) from barometer. Prior to use of the barometer during sampling, it should be calibrated next to a reliable source such as the barometer at a local airport.
- *Latitude (degrees)* – Sample latitude location in degrees (from global positioning system (GPS)).
- *Latitude (minutes)* – Sample latitude location in minutes (from GPS).
- *Longitude (degrees)* – Sample longitude location in degrees (from GPS).
- *Longitude (minutes)* – Sample longitude location in minutes (from GPS).
- The calibration values for the sampler (*Msc, Bsc, Rsc*) and PS1 orifice transfer standard values (*Mstc, Bstc, Rstc*). These can be obtained from the associated "PS1 Calibration Sheet".

6-5.6 PS1 SAMPLER SETUP AND SAMPLE COLLECTION

Note: The 10-foot exhaust hose should vent downwind. This will help prevent the same air from being resampled.

1. Remove the aluminum foil cover from the inlet, insert the sampling module into the sampler connector and push down the two locking arms completely.
2. Remove the protective cover from the loaded sampling module. Make sure the finger nuts are retightened in order to hold the filter retaining ring in place. Avoid storing tools, aluminum foil or other items with the sampling module during a sampling event (storing items with the sampling module during sampling may introduce contamination).
3. Lower the sampler cover and relatch.
4. Reset the clock timer to 0000 minutes or record the initial clock timer reading if the timer cannot be reset.
5. Set the sampler start-stop timer for the sample run period.
6. Wait for the timer to start the sampler and adjust the flow controller valve for these magnehelic gauge readings.
   - For PUF cartridge sampling set the magnehelic gauge to a reading of 60 (or the maximum level if unable to reach 60 in H2O).

– For resin cartridge sampling set the magnehelic gauge to the maximum reading that can be obtained for the cartridge, which may only be as high as 13 in H_2O (the red handled flow controller lever is turned vertically).

7. It is preferable that the variac not be turned to the maximum voltage prior a sampling event, *unless the collected sample volume is estimated (calculated based on approximate flow and sample time) to be insufficient to support desired concentration detection limits (i.e. the volume is too small to yield a low enough concentration of the contaminants).* When the volumes are consistently too low, the sampler should be recalibrated with the variac set at a higher voltage. Refer to Appendix 6-5, Annex 1 to recalibrate.

8. After approximately 5 minutes of run time take a magnehelic gauge reading. If the reading has dropped, increase the flow back to the initial magnehelic setting by further opening the flow controller valve.

9. Record the magnehelic reading on the PS1 Sampler Field Data Sheet.

10. Make sure to record the ambient barometric pressure (in Hg) and the ambient temperature (°C) on the data sheet.

11. Return to the sampling site at least 3 times during the sampling event and record the magnehelic readings in the data sheet. Adjust the flow controller lever, if possible, until the initial magnehelic reading is attained (or else the maximum possible magnehelic reading).

12. At least 5 minutes prior to the end of a sampling event, return to the sampling site to record the final magnehelic reading.

6-5.7 PS1 SAMPLE MEDIA RECOVERY

As soon as possible after sampling, the operator should return to the monitoring site to retrieve the exposed sample media.

1. Record on the PS1 Sampler Field Data Sheet the following:
   – Record the final magnehelic reading just before the sampling period is to end, if possible.
   – Record the elapsed time of the sampling run in minutes.
   – If the sampler has already stopped, turn on the sampler and take a final magnehelic reading as soon as the reading is stable. Avoid arriving at the sampling site long after the sample has ended. This reduces the chance of contaminating the sample.
2. Turn off the PS1 sampler.
3. Install the cover plate on the sample module and hand tighten the 3 finger nuts.
4. Unlatch the sample module inlet fasteners and remove from the sampler.
5. Using clean aluminum foil, seal off the sample module inlet connector.
6. Obtain and record the ambient temperature (Ta) in °C.
7. Obtain and record the ambient barometric pressure (Pa) in in Hg.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

8. In comments section on PS1 Sampler Field Data Sheet note weather conditions, traffic in the area, or any other condition that might affect the sample.

6-5.8 SAMPLE MODULE RECOVERY PROCEDURE

These steps should be performed in a clean environment as close as possible to the sampling site. Avoid transporting the sampling module for long distances while it contains the sample cartridge. Additional contamination will be introduced to the sample.

1. Unscrew lid of the wide mouth jar with the sample number that matches the recovered cartridge.
2. Unscrew the sample module bottom from the sample module top.
3. While wearing surgical gloves remove the sample cartridge from the sample module bottom and place it on the original aluminum foil the sample cartridge came in.
4. Loosen the three finger nuts and remove the sample module cover plate.
5. Remove the sample module filter hold down ring and the Teflon top filter gasket.
6. Using Teflon tweezers, remove the filter and fold it in half twice and place it in the top of the sample cartridge.
7. Wrap the sample cartridge in the original aluminum foil the sample cartridge came in or use new clean aluminum foil if original foil is ripped.
8. Placed the wrapped sample cartridge back into the wide mouth jar it came in.
9. Reinstall the original securing packing that came in the wide mouth jar.
10. Install the lid on the jar and seal. Gently shake the jar to check for cartridge movement. If the cartridge rattles, remove the lid and add additional packing, preferably clean aluminum foil.
11. Complete the affixed sample label on the sample jar.

6-5.9 PACKING AND SHIPPING INSTRUCTIONS

1. Refrigerate samples at 4 °C until ready for shipment to the analytical laboratory.
2. Ship samples on ice as soon as possible since sample holding time should not exceed 14 days. Make sure the jars are secure in the shipping containers. If the jars rattle in the container, add additional packing.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

Air - PS1 Field Data Sheet

Section I - Administrative Data		
1. Sample ID*:	2. Collected By*:	11. Lot ID:
3. Function:	4. Unit/Spec ID:	12. Job No:
5. Country:	9. Mission ID:	13. Project No:
6. Operation:	10. Shipping ID:	14. Event ID:
7. Sampling Date*:	15. Sample Notes:	
8. Sampling Time*:		

Section II - Field Data		
16. Cntr ID*:	18. PS1 Type: TOP / TOB	26. Blank? (Yes/No):
17. Media ID*:	19. Collector Name*:	27. Invalid Sample?:

SAMPLER DATA	Start/Pre	End/Post	Average
22. Date*:			
23. Time*:			
24. Ambient Temperature (oC)*:			
25. Ambient Pressure (in Hg)*:			
26. H Orifice (in H2O)*:			
27. Volume (m3)*:			

28. Reading	29. Time*	40. M Gauge*	41. M Std	42. Q Std	43. Qual Orifice
Initial					
6-Hour					
12-Hour					
18-Hour					
Mean					

34. Sampler Calibration Relationship	Slope (Mac):	Intercept (Mac):	Correlation (Mac):
35. Orifice Calibration Relationship	Slope (Mac):	Intercept (Mac):	Correlation (Mac):

GEOLOCATION	Decimal Degrees	OR	OTHER
36. Latitude*:			
37. Longitude*:			
39. Field Notes*:			

* Required Fields

17-Mar-09

Excerpt from USACHPPM DRAFT TG-251 –
Appendix 6-5 PS1 Sampling Instructions

[illegible] **Bold items are required entries**

PS1 FIELD DATA SHEET INSTRUCTIONS

SECTION I - ADMINISTRATIVE DATA

1 **Sample ID** - Sample ID [illegible] XXX_YYYY_DDD_ZZ
Where: XXX - [illegible]
YYYY - [illegible]
DDD - [illegible]
ZZ - P = primary, C = [illegible], FB = field blank
2 Location - [illegible]
3 Country - [illegible]
4 Operation - [illegible] Operation Allied Force [illegible] if applicable
5 **Sampling Date** - [illegible] 01-Jan-2000
6 **Sampling Time** - [illegible]
7 **Collected By** - [illegible]
8 Unit [illegible]
9 [illegible] ID - [illegible]
10 Shipping ID - Shipping ID associated with sample (e.g. Fedex tracking number)
11 Lab ID - [illegible] if applicable
12 Job No. - [illegible]
13 Project No. - Project number assigned by laboratory or project officer
14 Europe ID - [illegible] CHPPM-Europe laboratory, if applicable
15 **Sampling Notes** - Any notes or comments associated with the sample (e.g. [illegible])

SECTION II - FIELD DATA

Note: The Sample ID, Sampler ID, Start Date and Media ID should also be recorded on the sample label

16 **Unit ID** - Serial number off of sampling unit
17 **Media ID** - ID [illegible]
18 **PS1 Type** - PS1 type either [illegible]
19 **Collection Name** - Name of the person operating the sampler
20 **Blank** - Is the sample a QA/QC blank, yes or no
21 Invalid Sample - Is the sample invalid, if so why? (select appropriate code)
NV - Sample is valid [illegible]
M - Missing Field Data - e.g. sample time, flow rate, etc.
P - Pump Malfunction - e.g. pump failed
S - Sampler Malfunction - other part of sampler failed, e.g. tubing, etc.
D - [illegible] Sampling Media - [illegible] damage during shipment or sampling episode
22 **Date** - Date on which the sampling episode was started and ended (DD-MON-YR - e.g. [illegible])
23 **Time** - Time which the sampling episode was started and ended in 24 hour standard (e.g. 13:30)
24 **Ambient Temp** - Ambient temp. in degrees celsius from thermometer at the start and end of the sampling episode
25 **Ambient Pressure** - Ambient pressure in inches Hg from barometer at the start and end of the sampling episode
26 **H [illegible] (in H2O)** - [illegible] at the start of the sampling, in inches of water
27 Volume - Sample volume in cubic meters [illegible] [Calculated]
28 Reading - [illegible] initial and final reading
29 **Time** - Time of reading in 24 hour standard (e.g. 13:30)
30 **M Gauge** - [illegible] in inches of Hg

31 $$M_{std} = \sqrt{M_{[illegible]} \cdot \frac{Pa \cdot 25.4}{760} \cdot \frac{298}{Ta + 273}}$$ [Calculated]

32 $$Q_{std} = \frac{(M_{std} - B_s)}{M_s}$$ [Calculated]

33 $$Q_{std}\ Orifice = \frac{\sqrt{H_{[illegible]} \cdot \frac{Pa \cdot 25.4}{760} \cdot \frac{298}{Ta + 273}} - B_o}{M_o}$$ [Calculated] (Only calculated for the initial and final $H_{[illegible]}$)

34 **Sampler Calibration Relationship** - Slope, Intercept, and Correlation Coeff. of sampler from "PS1 Calibration Field Data Sheet"
35 **Orifice Calibration Relationship** - Slope, Intercept, and Correlation Coeff. of orifice from "PS1 Calibration Field Data Sheet"
36 **Latitude** - Sample latitude location in decimal degrees (from GPS)
37 **Longitude** - Sample longitude location in decimal degrees (from GPS)
38 **MGRS** - Location in MGRS from GPS [illegible]
39 **Final Notes** - Notes [illegible] (e.g. unusual circumstances, weather, potential pollution sources, etc.)

Appendix 6-5 - Annex 1

PS1 Sampler Calibration

6-5-1.1 Purpose

The instructions in this Annex are written as a step-by-step procedure to conduct a multi-point calibration on the PS1 sampler and establish a sampler specific calibration relationship prior to conducting field sampling.

6-5-1.2 Application

The procedures outlined in this Annex are specific to the PS-1 sampler described herein. The calibration of the PS-1 is required when:

- When the unit is moved to a new sample location.
- When using a new unit in the field
- After major repairs or maintenance of the PS-1 (e.g. motor brushes are due to be replaced after each 400-500 hours of operation).
- Whenever an audit point deviates from the calibration curve by more than ±7%.
- When a different sample collection media, other than that which the sampler was originally calibrated for, will be used for sampling.
- At the frequency specified in the user Standard Operating Procedure (SOP) manual in which the samplers are utilized.

NOTE: The PS-1 sampler is designed to use glass cartridges packed with either granular XAD-2 resin or a polyurethane foam (PUF) plug. Due to the different flow characteristics of the two packings, a slightly different calibration ranges are needed. Generally, the range of calibration points selected on the magnehelic should match the range the sampler is expected to operate in during a sampling event (see Section 6-5-1.4).

6-5-1.3 Equipment Inventory

The equipment listed in Table 6-5-1-1 are required to conduct the calibration of the PS-1 sampler.

Table 6-5-1-1. Equipment for Calibration of PS-1 Sampler

ITEM DESCRIPTION	QUANTITY
Complete PS1 sampler to include the housing, a motor, venturi magnehelic assembly and exhaust hose.	1
Empty sample cartridge	1
PS1 calibration kit to include the flow rate transfer standard orifice, a manometer, manometer calibrating fluid, and orifice calibration sheet.	1
Thermometer	1
Barometer (must be)	1
Sample Module	2
Sample Module Preparation Procedure	1

If a barometer is unavailable, barometric pressure can be obtained from the nearest airport meteorological station and then corrected for any elevation difference (subtract 2.5 mm Hg per each 30 meter increase in elevation from the airport, add 2.5 mm Hg per each 30 m drop in elevation from the airport).

An appropriate power source must support approximately 15 amps and be properly configured to the sampler motor specifications. A 120 volt/60 Hz motor can only be plugged into a 120 volt/60 Hz power source (United States standard) and a 240 volt/50 Hz motor can only be plugged into a 240 volt/50 Hz power source (European Standard). Mixing these power requirements will destroy the sampler motor.

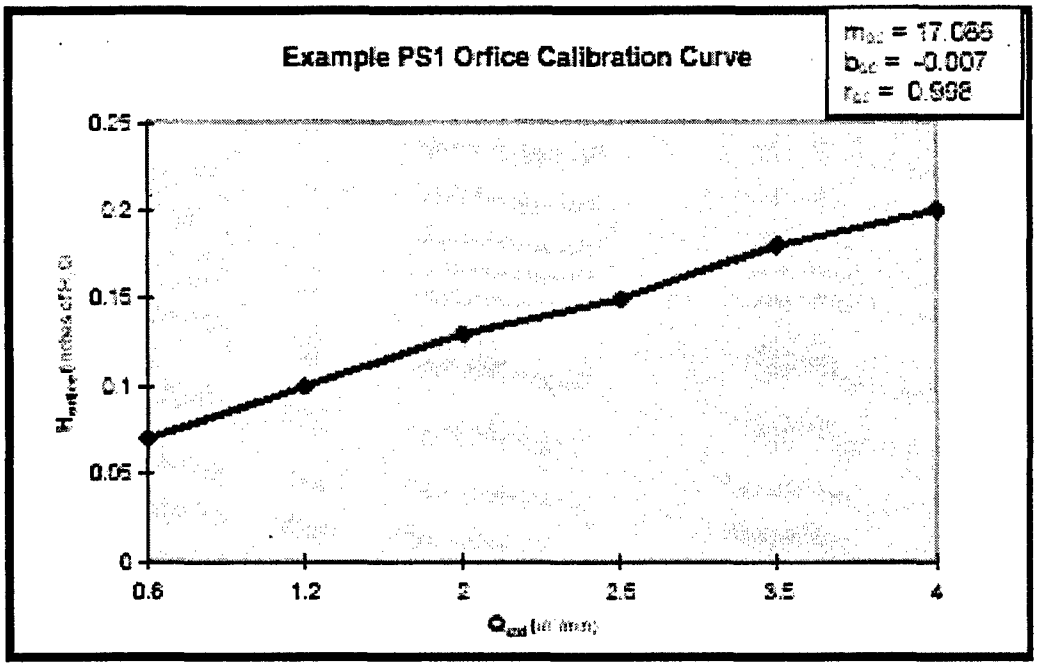
6-5-1.4 PS-1 Calibration Procedure

1. NOTE: For PUF sampling, the calibration points should be 80, 40, 30, and 20 inches of H_2O on the magnehelic. For resin cartridges the calibration points should be 25, 20, 15, 10, and 5 inches of H_2O. If during an actual sampling event the magnehelic reading is outside the range of calibration points, the sampler should be recalibrated using a range that includes this reading.

2. Record the following information on the "PS1 Calibration Sheet"

   - Sampler ID
   - Calibration Date
   - Julian day
   - Location
   - Operator
   - Orifice Calibrator SN
   - Orifice Calibration Date
   - Slope (M_c)

- Intercept (B_{Qc})
- Correlation Coefficient (R_{Qc})



3. Place a blank adsorbent cartridge into the sampling module of the PS1 sampler. NOTE: There should be a polytetrafluoroethylene (PTFE) gasket between the inside module bottom and the blank cartridge bottom. There should also be a PTFE gasket between the cartridge top and the base of the module top for proper sealing.

4. Install the flow rate transfer standard orifice on the sampling module and tighten the three finger nuts hand tight (do not install the filter hold down ring prior to installing the orifice standard). Tighten alternate corners little by little to ensure even tightening.

5. Open the valves on the manometer 3/4 to 1 turn and connect tubing to the manometer. Gently blow into the connecting tubes to check the manometer for free fluid movement. If there is no fluid movement or does not appear to flow freely, the valves may not be open far enough.

6. Gently blow into the manometer tubing until a pressure of 5 to 6 inches of water is reached, then pinch off the tubing. Observe the manometer pressure for movement. There should be no movement for at least 15 seconds. If there is movement in the manometer, the manometer connection has a leak somewhere in the line. Inspect connections for leaks and repeat this process until no movement is observed in the water level (a good possibility is that the manometer valves are open too far).

7. Turn the sampler on and turn the lever vertical so that the flow controller valve is fully open.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

8. Set the voltage variac so that the magnehelic reads between 70 and 80 in H_2O.

9. Perform a leak test on the sampler by blocking the orifice transfer standard top hole and pressure tap hole. Use the palm of the hand and a finger or hole-plugs. Gently rock the orifice while observing the PS1 sampler magnehelic gauge. The gauge should read zero and not waiver. Make sure the manometer is not connected to the transfer standard pressure port while performing a leak check.

Caution: Plug the holes no more than 10 seconds to prevent damage to the motor.

10. Turn the sampler off.

11. Record the ambient temperature (Ta) and ambient barometric pressure (Pa) on the "PS1 Calibration Sheet".

12. Connect the PS1 orifice transfer standard kit manometer to the orifice pressure tap. The assembled sampler with the transfer standard should resemble Figure 6-5-1-1.

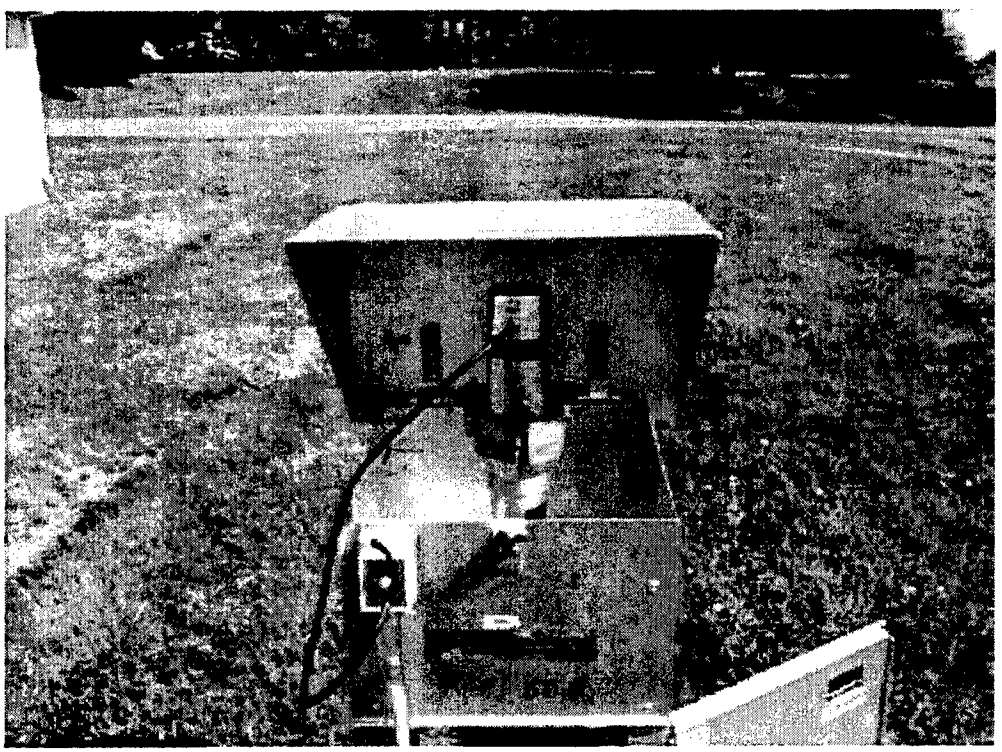


Figure 6-5-1-1. Assembled Transfer Standard, sample manifold, and manometer.

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

13. Turn on the sampler, ensure the flow controller valve restrictor leaver is vertical) is fully open and the voltage variac is adjusted so that a sample flow rate corresponding to 110% of the desire flow rate (typically 0.20–0.28 m^3/min) is indicated on the magnehelic gauge (approximately 70-80 in H_2O).

14. Allow the motor to warm up for approximately 5 minutes

Note: If the calibration is being conducted in windy conditions the sampler inlet may be partially lowered over the orifice to act as a wind shield. Block the sampler inlet, leaving at least 2 inches clearance at the bottom.

15. Obtain initial calibration point.

1.) Adjust the flow controller valve until the magnehelic gauge reads 30 in H_2O if sampling with XAD 2 resin. If sampling with PUF, start at 70 in H_2O.

2.) Record the manometer deflection from the orifice in the "Manometer" column on the "PS1 Calibration Sheet" - Calibration Data Section. Reading taken to the nearest 0.05 inch on each leg, then added. See Figure 6-5-1-2.

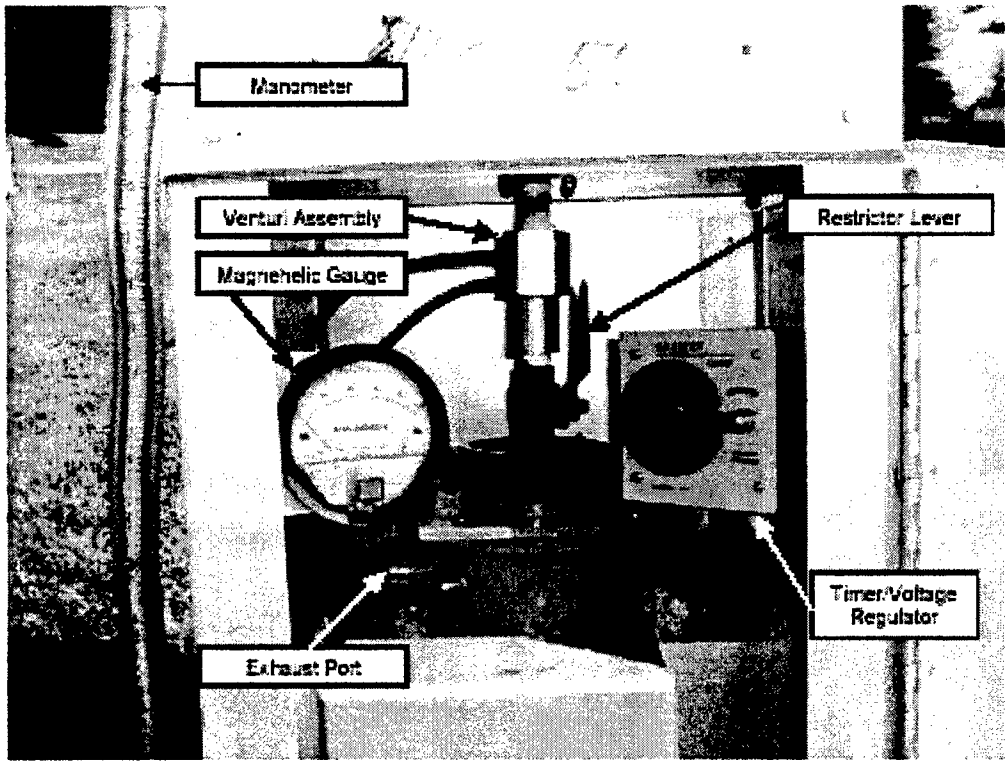


Figure 6-5-1-2. Interior section of PS-1

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

16. Repeat step 11 for magnehelic readings of 25, 20, 15, 10, and 5 in H_2O for XAD-2 sampling. Repeat step 11 for readings of 60, 50, 40, 30, and 20 in H_2O for PUF sampling.

17. Perform calculations to determine Qstd and Mstd (Section 6-5-1.5).

6-5-1.5 PS-1 Calibration Calculations

The Qstd and Mstd must be calculated for each of the calibration points of 5, 10, 15, 20, 25, and 30 in H_2O (the same goes for PUF sampling calibration points).

1. Calculate the "Qstd" and "Mstd" columns on the "PS1 Calibration Sheet" - Calibration Data Section and conduct linear regression. Use the equations 1 and 2 below or on the "PS1 Calibration Sheet" - Equations Section. The "DESP Environmental Database" may also be used to calculate calibration parameters.

$$Q_{std} = \frac{\sqrt{Manometer * \frac{Pa}{760} * \frac{298}{Ta}} - B_{qc}}{M_{qc}} \qquad (Eq.1)$$

Where:

Manometer = manometer reading in inches of water

Pa = Ambient barometric pressure in millimeter of mercury (mm Hg)

Ta= Ambient temperature in degrees Kelvin (°K) [°K=°C+273]

Bqc = Intercept obtained from the calibration orifice

Mqc= Slope obtained from the calibration orifice

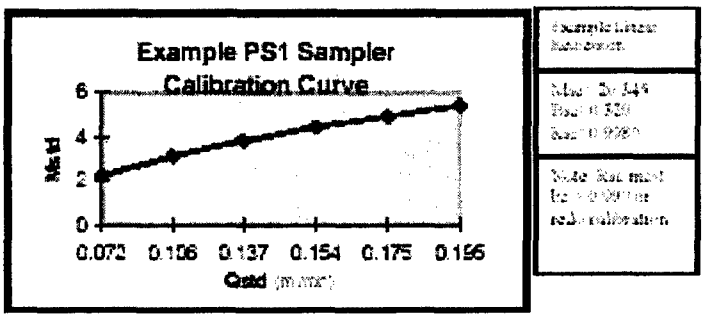
$$M_{std} = \sqrt{Magnehelic * \frac{Pa}{760} * \frac{298}{Ta}} \qquad (Eq.2)$$

Where:

Magnehelic = magnehelic reading in inches of water

Pa = Ambient barometric pressure in millimeter of mercury (mm Hg)

Ta= Ambient temperature in degrees Kelvin (°K) [°K=°C+273]



2. Complete the table and equations in the linear regression worksheet to calculate the Slope (M_{std}), Intercept (B_{std}), and Correlation Coefficient (R_{std}). These calculations can be done longhand using the calculations below. It is recommended that a scientific calculator that does linear regression or a spreadsheet program be used to perform these calculations to decrease the margin for error.

$$M_{std} = \frac{6\sum xy - \left(\sum x\right)\left(\sum y\right)}{6\sum x^2 - \left(\sum x\right)^2} \qquad (Eq\ 3)$$

Where: x = Q_{std} for each respective calibration point

y = M_{std} for each respective calibration point

$$B_{std} = \bar{y} - M_{std}\bar{x} \qquad (Eq\ 4)$$

Where: $\bar{y}$ = average of the M_{std} values

M_{std} = Slope obtained from the PS1 sampler calibration

$\bar{x}$ = average of the Qstd values

$$R_{std} = \frac{\sum xy - \left[\frac{\left(\sum x\right)\left(\sum y\right)}{n-1}\right]}{\left\{\left[\sum y^2 - \frac{\left(\sum y\right)^2}{n-1}\right] * \left[\sum x^2 - \frac{\left(\sum x\right)^2}{n-1}\right]\right\}^{\frac{1}{2}}} \qquad (Eq\ 5)$$

Where x = Q_{std} for each respective calibration point

y = M_{std} for each respective calibration point

n = number of calibration points, 6.

3. Calculate the "Qstd", and "Deviation" columns on the "PS1 Calibration Sheet" - Calibration Data Section from the linear regression. Use the equations 3 and 4 or on the "PS1 Calibration Sheet" - Equations Section. The "DESP Environmental Database" may also be used to calculate calibration.

$$Q_{std} = \frac{(M_{std} - B_{se})}{M_{se}} \qquad (Eq.6)$$

Where:

$$\%Deviation = \frac{(Q_{std} - Q'_{std})}{Q_{std}} \qquad (Eq.7)$$

Mstd = Mstd from equation (1)

Bse = Intercept obtained from the PS1 sampler calibration.

Mse = Slope obtained from the PS1 sampler calibration.

6-5-1.6 Calibration Requirements

The following two criteria must be met to ensure that the PS-1 calibration is valid.

1. Standard deviations for each calibration point must be within ±4%
2. The correlation coefficient (R_{se}) must be greater than 0.990

If any of the calibration point standard deviations or the R_{se} fall outside of these limits the PS-1 sampler must be re-calibrated.

Air - PS1 Calibration Field Data Sheet

Section I - Administrative Data

*1. Sampler ID**	*5. Calibration Date**	*10. Calib Orifice S/N**
*2. Location**	*6. Julian Date**	*11. Calib Orifice Date*
3. County	*7. Operator**	*12. Slope (Mw)**
4. Operation	*8. Ambient Temp (Ta) °C**	*13. Intercept (Bw)**
15. Calibration Notes	*9. Ambient Pressure (Pa) in Hg**	*14. Corr Coeff (Rw)**

Section II - Sampler Calibration

16. Reading	*17. Magnehelic Reading (Mgauge) (in H2O)**	*18. Manometer Reading (Horifice) (in H2O)**	*19. Qstd X- Axis(1) (m3/min)*	*20. Mstd Y- Axis(2)*	*21. Q'std (1) Derived Flow (m3/min)*	*22. % Deviation (4)*
1						
2						
3						
4						
5						
6						

Equations

$$PS = \left[\left(\frac{P_a * 25.4}{760} \right) + \frac{298}{T_a + 273} \right] = \boxed{}$$

(1) $$Q_{std} = \frac{\sqrt{H_{(std)}} * PS - B_w}{M_w}$$

(2) $$M_{std} = \sqrt{M_{(std)}} * PS$$

After linear regression of Mstd and Qstd

(3) $$Q_{std} = \frac{(M_{std} - B_w)}{M_w}$$

(4) $$\%Deviation = \frac{(Q_{std} - Q_{std})}{Q_{std}}$$

If % deviation is greater than 4% redo calibration

Linear Regression Worksheet

Reading	*XY*	x^2
1		
2		
3		
4		
5		
6		

$\bar{X}$ =	
$\bar{Y}$ =	
$\sum x$ =	
$\sum y$ =	
$\sum xy$ =	
$\sum x^2$ =	

$$B_w = \bar{Y} - M_w \bar{X}$$

$$M_w = \frac{6\sum xy - (\sum x)(\sum y)}{6\sum x^2 - (\sum x)^2}$$

$$M_w = \frac{\boxed{} - \boxed{}}{\boxed{} - \boxed{}}$$

*21. Slope (Mw)**	*24. Intercept (Bw)**	*25. Corr Coeff (Rw)**

** Required Fields*

11-May-00

Excerpt from USACHPPM DRAFT TG-251 – Appendix 6-5 PS1 Sampling Instructions

CAPCM-DZ-CP *Bold Items are required entries*

PSI SAMPLER CALIBRATION INSTRUCTIONS

SECTION I - ADMINISTRATIVE DATA

1. **Sampler ID** - Unique ID of sampler (e.g. serial number or MMCK number)
2. **Location** - Name or location of calibration
3. **Country** - Country in which location or camp is located.
4. **Operation** - Name of operation ongoing in the area of the sample (e.g. Operation Allied Force/OMFS, OIF / OEF/OIR)
5. **Calibration Date** - Date calibration was conducted
6. **Julian Day** - Consecutive given specific Julian day calibration was conducted. A Julian day is the sequential number a day of the year. The database can be used to calculate the Julian day of the year.
   Example: 01-Jan-1998 would be Julian day 98001 where "98" is the last digits of the year and "001" is the day of the year
   Example: 31-Dec-2000 would be Julian day 00366 where "00" is the last digits of the year and "366" is the day of the year (leap year)
7. **Operator** - Name of person conducting the calibration
8. **Ambient Temperature (Ta)** - Ambient temperature at the time of calibration in °C
9. **Ambient Pressure (Pa)** - Atmospheric pressure at the time of calibration in inches of mercury (in Hg)

All orifice calibration data can be obtained from the orifice calibration sheet issued with the orifice calibrator.

10. **Orifice Calibration SN** – The serial number of the calibration orifice
11. **Orifice Calibration Date** - Date calibration orifice was calibrated to a primary standard
12. **Slope (M_{oc})** – Slope of Orifice Calibration curve.
13. **Intercept (B_{oc})** – Slope of Orifice Calibration curve.
14. **Correlation Coefficient (R_{oc})** – Slope of Orifice Calibration curve
15. **Calibrator Notes** - General notes on the calibration

SECTION II - SAMPLER CALIBRATION DATA

16. **Readings** – Calibration reading number predetermined to be (1, 2, 3 4, 5, and 6)
17. **Magnehelic Reading** - Magnehelic reading from sampler, pre-determined to be (5, 10, 15, 20, 25, and 30)
18. **Manometer Reading (H_{manom})** - Manometer reading from the calibration orifice for each magnehelic flow setting in inches of water
19. **Q_{std} (X-Axis)** - derived from the orifice calibration relationship using the following equation:

$$Q_{std} = \frac{\sqrt{Manometer * \frac{Pa * 25.4}{760} * \frac{298}{Ta + 273}} - B_{oc}}{M_{oc}}$$

Manometer = manometer reading, from calibration of flows in inches of water
Pa = Ambient barometric pressure in inches of mercury (in Hg)
Ta = Ambient temperature in degrees celsius (°C)
Boc = Intercept obtained from the calibration orifice
Moc = Slope obtained from the calibration orifice

20. **M_{std} (Y-Axis)** - Magnehelic reading corrected to standard temperature and pressure using the following equation:

$$M_{std} = \sqrt{Magnehelic * \frac{Pa * 25.4}{760} * \frac{298}{Ta + 273}}$$

Magnehelic = magnehelic reading in inches of water
Pa = Ambient barometric pressure in inches of mercury (in Hg)
Ta = Ambient temperature in degrees celsius (°C)

Conduct linear regression of Qstd (X-axis) and Mstd (Y-Axis), either by using regression worksheet, calculator or spreadsheet to obtain sampler calibration:

Slope (Msc), Intercept (Bsc) and Correlation Coefficient (Rsc) if *Rsc < 0.98 calibration must be redone.*

21. **Q'_{std} (Derived Flow)** - Standard flow calculated using the following equation:

$$Q'_{std} = \frac{(M_{std} - B_{sc})}{M_{sc}}$$

Mstd = Mstd flow per set sequence
Bsc = Intercept obtained from the PS1 sampler calibration
Msc = Slope obtained from the PS1 sampler calibration

22. **%Deviation** - Percent deviation from Q'_{std} and Q_{std} Orifice

$$\%Deviation = \frac{(Q_{std} - Q'_{std})}{Q'_{std}} * 100$$

If % deviation is greater than 4% calibration must be redone.

23. **Slope (M_{sc})** – Sampler calibration slope derived from linear regression
24. **Intercept (B_{sc})** - Sampler calibration intercept derived from linear regression
25. **Correlation (R_{sc})** - Correlation coeff of calibration

11-May-2000 *file: PS1_Calibration_Database_instructions_V1.0*

Appendix D
Oil Well Fire Equipment List

Oil Well Fire Equipment List				
#	Container	Item	Unit	Quantity
1	Blue Box	PS1 Sampler Body	ea	1
1	Blue Box	PS1 Extra motor	ea	1
1	Blue Box	Power Strip	ea	1
1	Blue Box	Isopropyl alcohol	bottle	1
1	Blue Box	PS1 Calibrator	ea	1
2	Blue Box	PS1 Sampler Hood	ea	2
2	Blue Box	Sampler Heads	ea	2
2	Blue Box	Sampler Feet	ea	4
2	Blue Box	Nalgene Bottles	ea	2
2	Blue Box	PS1Operation Instructions	ea	1
2	Blue Box	550 Cord	ea	1
2	Blue Box	Aluminum Foil	roll	1
2	Blue Box	Screwdriver Set	ea	1
3	Cardboard Box	TSP Body	ea	1
3	Cardboard Box	TSP Head	ea	1
3	Cardboard Box	TSP Motor	ea	1
3	Cardboard Box	TSP Filter Holder	ea	2
4	Cardboard Box	TSP Calibrator	ea	1
5	Cardboard Box	Tripod Legs	ea	3
6	Pelican Case	SKC Pocket Pump	ea	3
6	Pelican Case	SKC Universal Chargers	ea	3
6	Pelican Case	Dry Cal Calibrator	ea	1
6	Pelican Case	TO17 Calibration Tube	ea	1
6	Pelican Case	SKC Pocket Pump Instructions	ea	3
6	Pelican Case	Sampling tube holder and tubing	ea	3
7	Pelican Case	Mini Vol Unit	ea	1
7	Pelican Case	Mini-Vol Sampling Heads	ea	2
7	Pelican Case	Mini-Vol Batteries	ea	2
7	Pelican Case	Mounting bracket and cradle	ea	1
7	Pelican Case	Mini-Cal Calibrator	ea	1
8	Pelican Case	Mini Vol Unit	ea	1
8	Pelican Case	Mini-Vol Sampling Heads	ea	2
8	Pelican Case	Mini-Vol Batteries	ea	2
8	Pelican Case	Mounting bracket and cradle	ea	1
9	Cardboard Box	Environmental Sampling Backpack	ea	1
	?	Sampling Media - PM10 (Mini-Vol Sampler)	ea	20
	?	Sampling Media - TSP	ea	20
	?	Sampling Media - TO13 (PS1 Sampler)	ea	5
	?	Sampling Media - TO17 (SKC Pumps)	ea	21
	?	Sampling Media - OVM	ea	20

	Cardboard Box	Deployment Potable Water Sampling Kit / with cooler	ea	2
	Cardboard Box	Deployment Soil Sampling Kit (3 containers) / with cooler	ea	1
	Cardboard Box	Field Notebooks	ea	2
	Cardboard Box	Sampling instructions and datasheet binder	ea	1
	Cardboard Box	Pens	ea	2
	Cardboard Box	Packing Tape	ea	3
	Cardboard Box	1600 Watt Transformer	ea	1

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
BROOKS CITY-BASE TEXAS

4 February 2009

MEMORANDUM FOR DTIC-OCQ
ATTN: LARRY DOWNING
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FROM: 711th HPW/OMA (STINFO)
2513 Kennedy Circle
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SUBJECT: Changing the Distribution Statement on a Technical Report

This letter documents the requirement for DTIC to change the distribution statement from "C" to "A" (Approved for public release; distribution is unlimited.) on the following technical report: AD Number ADB310375, IOH-RS-BR-SR-2005-0002, Sampling and Analysis Plan for the Collection of Ambient Air Samples at Receptor Locations from Open Pit Burning Operations in the Deployed Environment.

If additional information or a corrected cover page and SF Form 298 are required please let me know. You can reach me at DSN 240-6019 or my e-mail address is sherry.mathews@brooks.af.mil.

Thank you for your assistance in making this change.

Sherry Y. Mathews

SHERRY Y. MATHEWS
711th HPW STINFO Officer
Previously AFIOH STINFO Officer